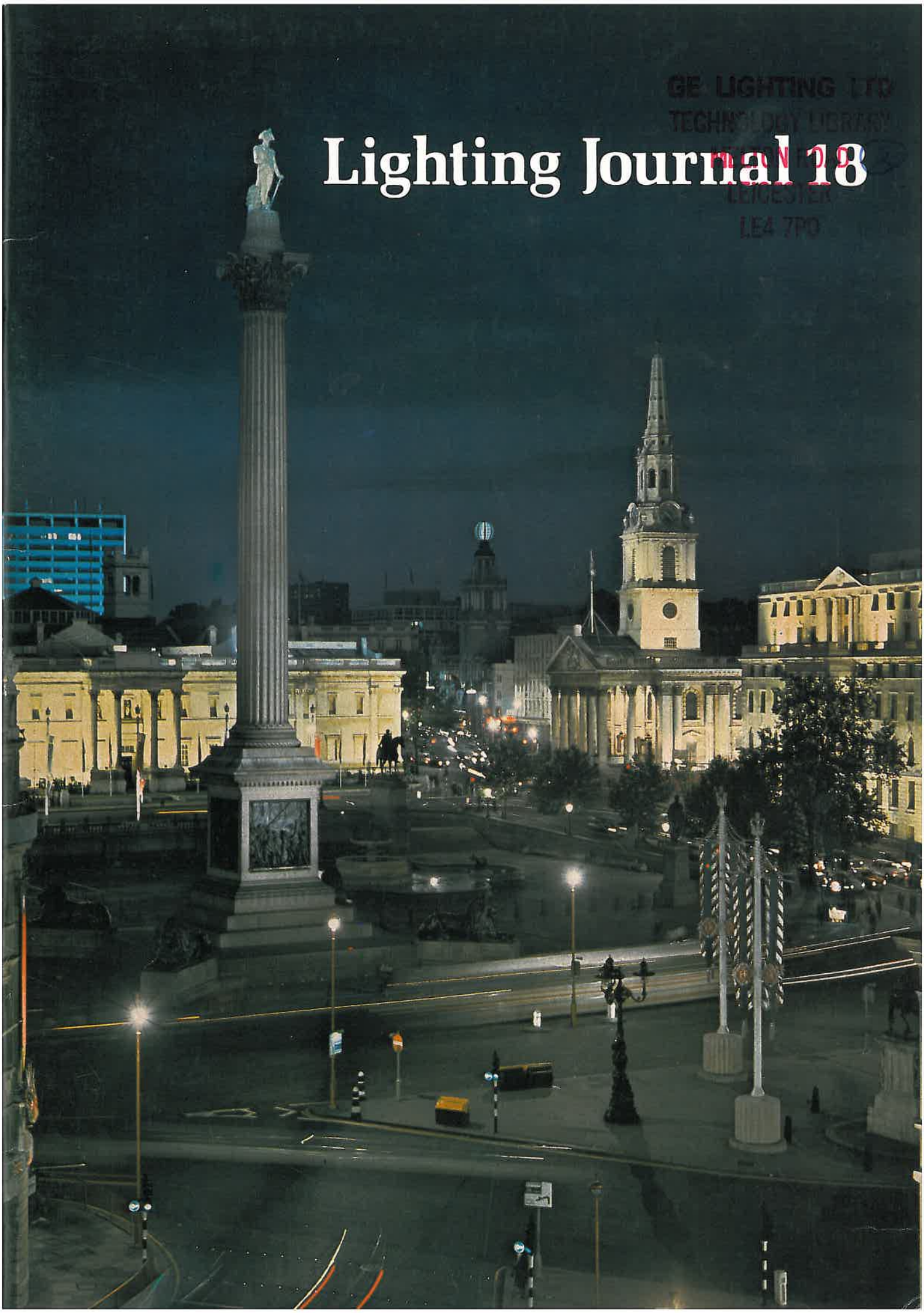


Lighting Journal 18

GE LIGHTING LTD
TECHNOLOGY LIBRARY
LEICESTER
LE4 7PD

Part of the large "Arena" integrated lighting and air-conditioning ceiling system at the Copley Comprehensive School at Thameside, Manchester. Air is extracted through the twin-lamp fluorescent luminaires supporting the ceiling tiles and maintains the fluorescent tubes at their optimum operating temperature.

Lighting Journal 18

Winter 1977

Editor R L C Tate
Editorial Board
A H Nash R E Allen M A Cayless
R C Kember W K Lumsden
A M Marsden C H Phillips

Lighting Journal aims to present a balanced picture of the activities of Thorn Lighting Ltd. As a result of this, it is unavoidable that the emphasis in successive issues should shift from research to manufacture, from outdoor to indoor lighting, or from lamp technology to fittings manufacture.

In Lighting Journal No 17 we made no secret that the achievement of lighting two English cathedrals at the same time was something of which we felt justifiably proud, but we still found room to describe the activities of our Lighting Planning Departments, to have a look at lamp technology and to describe how lighting affects the vital industry of coal mining, both in providing efficient cap-lamps and in floodlighting the coal tips of a Kentish mine.

The current issue looks at the regulations governing the manufacture and performance of luminaires designed for use in hazardous areas and at the very varied applications of exterior lighting equipment. Research into the factors governing good street lighting design by means of a team using a mobile lighting laboratory recording its investigations on video tape is described, while the subject of another article is the quite different research carried out by Thorn's chemical laboratories to detect the minute impurities in gas fillings or raw materials that might adversely affect lamp life or light output.

We include a page of 'Jubilee' pictures, but because floodlighting is not confined to the lighting of buildings or public monuments at times of national rejoicing, David Brook's article covers a wide range of industrial, commercial and sporting applications. The description of the lighting of the Malmö trotting track highlights the activities of Thorn Belysning in Sweden.

The issue closes with a short article on holography which has been described as the art of seeing something that isn't there and possibly never was where you saw it.

Contents

Luminaires in Explosive and Corrosive Atmospheres 3
R F Chatt and M G Oakley
Luminaires en atmosphères explosives ou corrosives
Leuchten in explosionsgefährdleten bzw korrosiven Atmosphären
Luminarias en ambientes explosivos o corrosivos
La apparociature d'illuminazione in atmosfere esplosive o corrosive

Light for Living Things 6
B W Jewess
La lumière et la vie
Licht für Lebenswesen
Luz para todo lo viviente
La luce e gli essere viventi

A Swedish Trotting Track 9
Bernth Jannson
Eclairage de la piste d'un hippodrome Suedois
Beleuchtung der Schwedischen Trabrennbahn
Alumbrado de la pista de carreras de caballos trotones de Malmoe, Suecia
Illuminazione di un ippodromo suedese

Some Thoughts on Floodlighting 12
D C T Brooks
Réflexion sur l'éclairage par projecteur
Einige gedanken zu dem Thema der Flutlichtbeleuchten
Algunas ideas sobre el alumbrado por projectores
Considerazione sui sistemi di illuminazione

Lighting for the Jubilee 16

Technologies of Luminaire Manufacture 18
L W V Turner
Technologie pour la fabrication d'appareils d'éclairage
Verfahren der Leuchtenfertigung
Technicas inherentes a la fabricación de luminarias
La tecnica di construzione dalle apparecchiature per illuminazione

Chemistry at Leicester 21
Dr V Goddard
La chimie à Leicester
Chimie in Leicester
Actividades quimicas en Leicester
La chimica a Leicester

A Mobile Road Lighting Laboratory 25
R Hargroves and J Green
Laboratoire mobile d'éclairage urbaine
Ein fahrbares Straßenbeleuchtungslabor
Laboratorio ambulante de alumbrado de carreteras
Un laboratorio semovente per l'illuminazione stradale

Holography and its Applications 28
J R Coaton and I Connor
L'holographie et ses applications
Die Holographie und ihre Anwendungen
Holographia y sus applicazione
L'Holographia e la relative applicazione

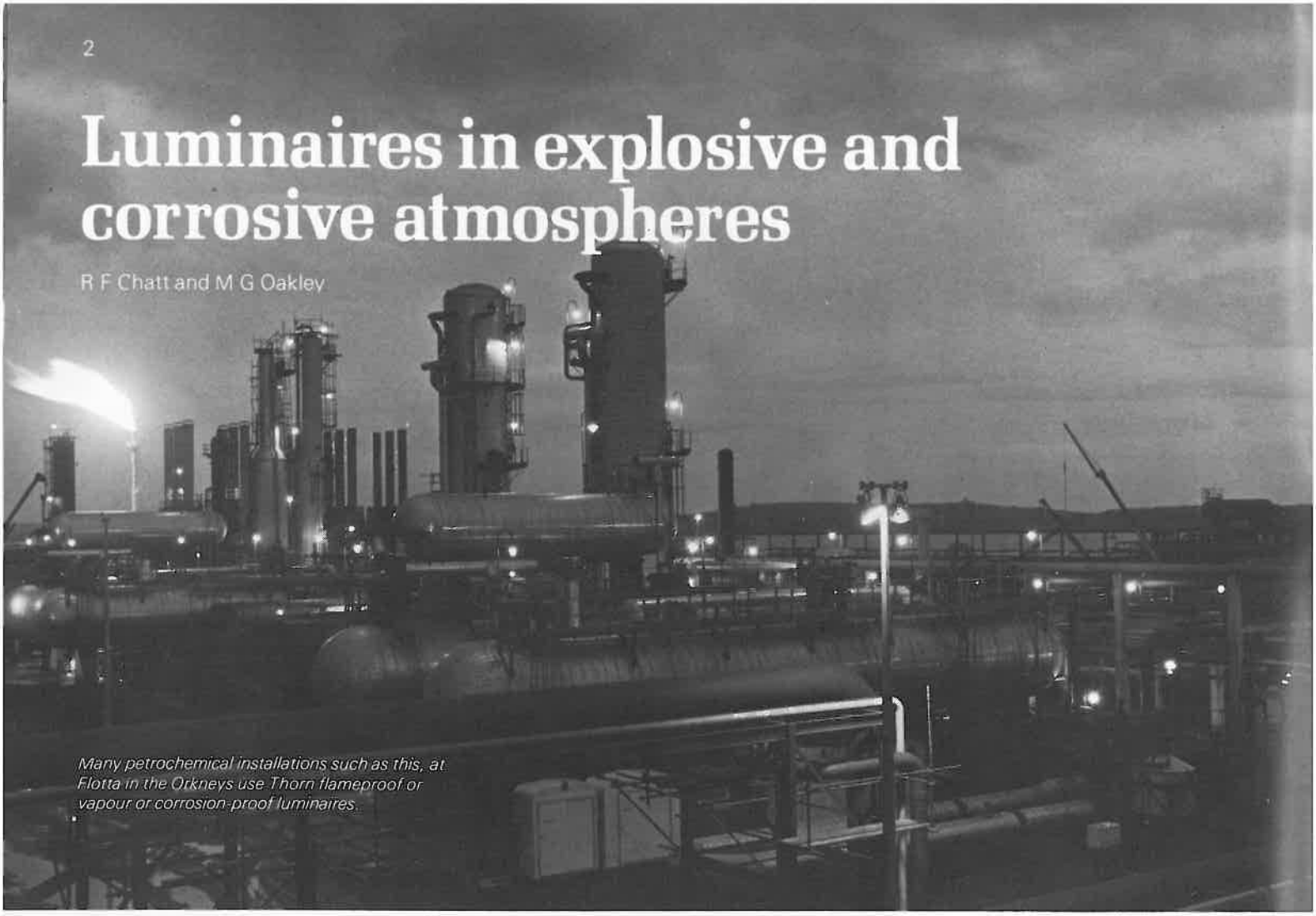
Translations 29
Traductions
Ubersetzung
Traducciones
Traduzioni

Published by Thorn Lighting Limited
Thorn House, Upper Saint Martin's Lane, London WC2H 9ED
Printed offset litho by
Robert Pearce & Co Ltd.
Designed by Zee Creative Ltd.

Our cover picture shows the Jubilee lighting in Trafalgar Square. The figure of Nelson is picked out by CSI lamps mounted in searchlights on the Admiralty building. (See page 16) The floodlit facade of Thorn House can be seen in the background.

Luminaires in explosive and corrosive atmospheres

R F Chatt and M G Oakley



Many petrochemical installations such as this, at Flotta in the Orkneys use Thorn flameproof or vapour or corrosion-proof luminaires.

Mr Chatt is Senior Product Executive for Industrial Lighting Fittings and Mr Oakley, Manager of the Petro-Chemical and Marine Lighting Division at Thorn House.

Explosive atmospheres are a potential problem in various industries: the petro-chemical industry in particular is one where gases and vapours could and do present a hazard and where faulty or incorrect electrical equipment could cause accidents of disastrous proportions.

All Thorn luminaires (lighting fittings) are designed to conform to the requirements of BS 4533 and the majority are used indoors in a clean, dry atmosphere at normal room temperatures. There are however very many situations where there is a risk of explosion or fire, and in these and places where exposure to damp or corrosive atmospheres is likely, specially designed luminaires must be used. The purpose of this article is to explain the regulations governing the design and manufacture of such equipment and to indicate the types of luminaire suitable for use in such situations.

The International Protection Code

The International Protection (IP) code classifies luminaires according to the degree of protection they have from the ingress of dust or small foreign bodies and against the entry of liquids. It does not indicate whether a luminaire is flame or explosion proof nor whether it is proof against corrosive liquids or vapour. For example a dustproof, rainproof luminaire would bear the code number IP53 but this would not guarantee protection against a highly corrosive atmosphere, and it would be necessary to determine the materials and construction for a decision to be made.

The two tables below show how the IP coding system works and it will be seen that the first of the two numerals refers to the left hand column of table 1 and the second to the right hand column. Thus, a dust-proof luminaire required to be hosed down, would have a marking of IP 55 with the appropriate symbols, a rain-proof luminaire with protection against finger contact within the enclosure would be IP 23 and so on. The second table makes the procedure quite clear.

A British Code of Practice

Equipment is classified according to the nature of the area in which it is to be used. The latest British Code of Practice BS 5345: 1976 covers the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres and the user or engineer handling plant design should refer to it before equipment is specified. The Code of Practice is divided into a number of parts; only Part 1 has been issued to date. This covers the basic requirements for all parts of the Code, the remaining twelve parts will deal with the installation and maintenance requirements appropriate to each of the types of protection that may be used to achieve electrical safety.

Classification of dangerous areas

At the present time BS 4533 does not cover flameproof luminaires which are classified as Zone 1 or 2 in accordance with BS 5345 Code of Practice. This is based on the internationally accepted concept of dealing with the risk of fire and explosion by area classification and recognises the degree of probability in which explosive concentrations of flammable gases or vapour may arise, both in frequency and duration.

Area classification is described in Part 2 (in course of preparation) of BS 5345 as follows:

Zone 0: In which an explosive gas-air mixture is continuously present, or present for long periods.

Zone 1: In which an explosive gas-air mixture is likely to occur in normal operation.

Zone 2: In which an explosive gas-air mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time.

This area classification does not deal with dusts for which classification is being developed. In a non-hazardous area normal electrical techniques apply.

The choice of Electrical Equipment

Prior to the selection of electrical equipment it is necessary to define the nature of the gas or vapour and the probability of its presence. In any plant a decision on the zone and the extent of each zone has to be made by the engineering and process teams. The type of protection would need to be of the appropriate class for use with the particular gas or vapour that might be present.

The main points taken into account in making a decision are:

1. Probability of presence of gas.
2. Quantity of gas or vapour.
3. Degree of ventilation available.
4. Nature of the gas (whether heavier than air).
5. Consequences of an explosion.

Equipment in Zone 0 Areas

No electrical apparatus, including lighting fittings, is allowed in a Zone 0 area. If such an area has to be lit the equipment must be mounted outside it; either at a distance using long-range floodlights, a technique used out of doors, or by projecting light through sealed windows, a method commonly found in spray booths.

Equipment for Zone 1 Areas

Until recently only flameproof and pressurised luminaires were allowed in Zone 1 hazardous areas. Today "increased safety" luminaires are also permitted. Zone 1 lighting equipment has to confirm to very stringent regulations and must comply at least with British Standards BS 229 (Flameproof enclosures) and BS 889 (Flameproof lighting fittings).

Flameproof luminaires

The requirements for flameproof luminaires are that all components capable of igniting flammable or explosive gas/air mixtures must be housed in an enclosure strong enough to withstand an internal explosion and made to prevent transmission of the flame to gases or vapours outside the luminaire. This is the type of construction employed in Thorn flameproof luminaires in which lamps and gear are enclosed in a heavy non-ferrous casting, with the lamps sealed in acrylic tubes. All joints and vents in the casting are of labyrinthine design to allow heated gases time to cool before they reach the external atmosphere. These flame paths are made to specifically designated dimensions.

Pressurised and "Increased Safety" Luminaires

Pressurised luminaires, as the name implies, are mounted on a pressurised pipe system through which air or an inert gas is pumped, so that the external explosive atmosphere cannot penetrate into the enclosure. The system is a great deal more expensive to install and operate than one using flameproof luminaires.

Increased safety luminaires designed for Zone 1 areas rely on the safety built into the internal components and not the enclosure. This protects against the possibility of excessive temperatures and the occurrence of electrical arcs and sparks. Fluorescent types are easily recognised as they use special single pin cold cathode TLX lamps. BS 5345 Part 6 is in course of preparation and when issued will give guidance on the application for type 'e' equipment.

Table taken from BS 775, defining IP numbers for luminaires.

Protection of persons against contact with live or moving parts inside the enclosure and protection of equipment against ingress of solid foreign bodies. Protection against contact with moving parts inside the enclosure is limited to contact with moving parts inside the enclosure that might cause danger to persons.

First characteristic numeral	Degree of protection
0	No protection of persons against contact with live or moving parts inside the enclosure No protection of equipment against ingress of solid foreign bodies
1	Protection against accidental or inadvertent contact with live or moving parts inside the enclosure by a large surface of the human body, e.g. a hand, but not protection against deliberate access to such parts Protection against ingress of large solid foreign bodies
2	Protection against contact with live or moving parts inside the enclosure by fingers Protection against ingress of medium size solid foreign bodies
3	Protection against contact with live or moving parts inside the enclosure by tools, wires or such objects of thickness greater than 2.5 mm Protection against ingress of small solid foreign bodies
4	Protection against contact with live or moving parts inside the enclosure by tools, wires or such objects of thickness greater than 1 mm Protection against ingress of small solid foreign bodies
5	Complete protection against contact with live or moving parts inside the enclosure Protection against harmful deposits of dust. The ingress of dust is not totally prevented, but dust cannot enter in an amount sufficient to interfere with satisfactory operation of the equipment enclosed
6	Complete protection against contact with live or moving parts inside the enclosure Protection against ingress of dust

Protection of equipment against ingress of liquid

Second characteristic numeral	Degree of protection
0	No protection
1	Protection against drops of condensed water Drops of condensed water falling on the enclosure shall have no harmful effect
2	Protection against drops of liquid Drops of falling liquid shall have no harmful effect when the enclosure is tilted at any angle up to 15° from the vertical
3	Protection against rain Water falling in rain at an angle equal to or smaller than 60° with respect to the vertical shall have no harmfull effect
4	Protection against splashing Liquid splashed from any direction shall have no harmful effect
5	Protection against water jets Water projected by a nozzle from any direction under stated conditions shall have no harmful effect
6	Protection against conditions on ships' decks (deck watertight equipment) Water from heavy seas shall not enter the enclosures under prescribed conditions
7	Protection against immersion in water It shall not be possible for water to enter the enclosure under stated conditions of pressure and time
8	Protection against indefinite immersion in water under specified pressure It shall not be possible for water to enter the enclosure

IP symbols are shown against the numbers to which they apply.

Equipment for Zone 2 Areas (Symbol Ex.N)

Two types of enclosure are permitted in Zone 2 areas. They must allow for: "Restricted" or "Unrestricted" breathing, but both types must comply with a minimum IP54 coding.

Restricted breathing implies that the enclosure may be hermetically sealed to prevent the ingress of gases or it may be gasketted to hinder their entry.

"Unrestricted breathing" is applied to a simple enclosed luminaire as opposed to one in which the diffuser is merely supported from a backspine.

All enclosures must withstand an

impact test but for restricted breathing enclosures, a breathing test is applied to each during production. A temperature limitation of 200°C (temperature classification T3) during operation is applied to every part of the *external* surface of a restricted breathing enclosure and to all *internal* and *external* surfaces of an unrestricted breathing enclosure.

BS 4533 Type N 1976 has been issued and when certified to this standard, Zone 2 equipment will be called Type of Protection 'N'. Luminaires will be classified according to their maximum surface temperature based on a peak ambient temperature of 40°C. By reference to a table which is also published in the BS 5345 Code of Practice ignition temperatures are not less than the maximum temperature class certified.

Characteristic letters	First characteristic numeral: Protection against contact & ingress of foreign bodies	Second characteristics numeral: Protection against ingress of liquid								
		0	1	2	3	4	5	6	7	8
IP	0	IP 00	—	—	—	—	—	—	—	—
	1	IP 10	IP 11	IP 12	—	—	—	—	—	—
	2	IP 20	IP 21	IP 22	IP 23	—	—	—	—	—
	3	IP 30	IP 31	IP 32	IP 33	IP 34	—	—	—	—
	4	IP 40	IP 41	IP 42	IP 43	IP 44	—	—	—	—
	5	IP 50	—	—	IP 53	IP 54	IP 55	—	—	—
	6	IP 60	—	—	IP 63	—	IP 65	IP 66	IP 67	IP 68

Corrosion Proof Luminaires

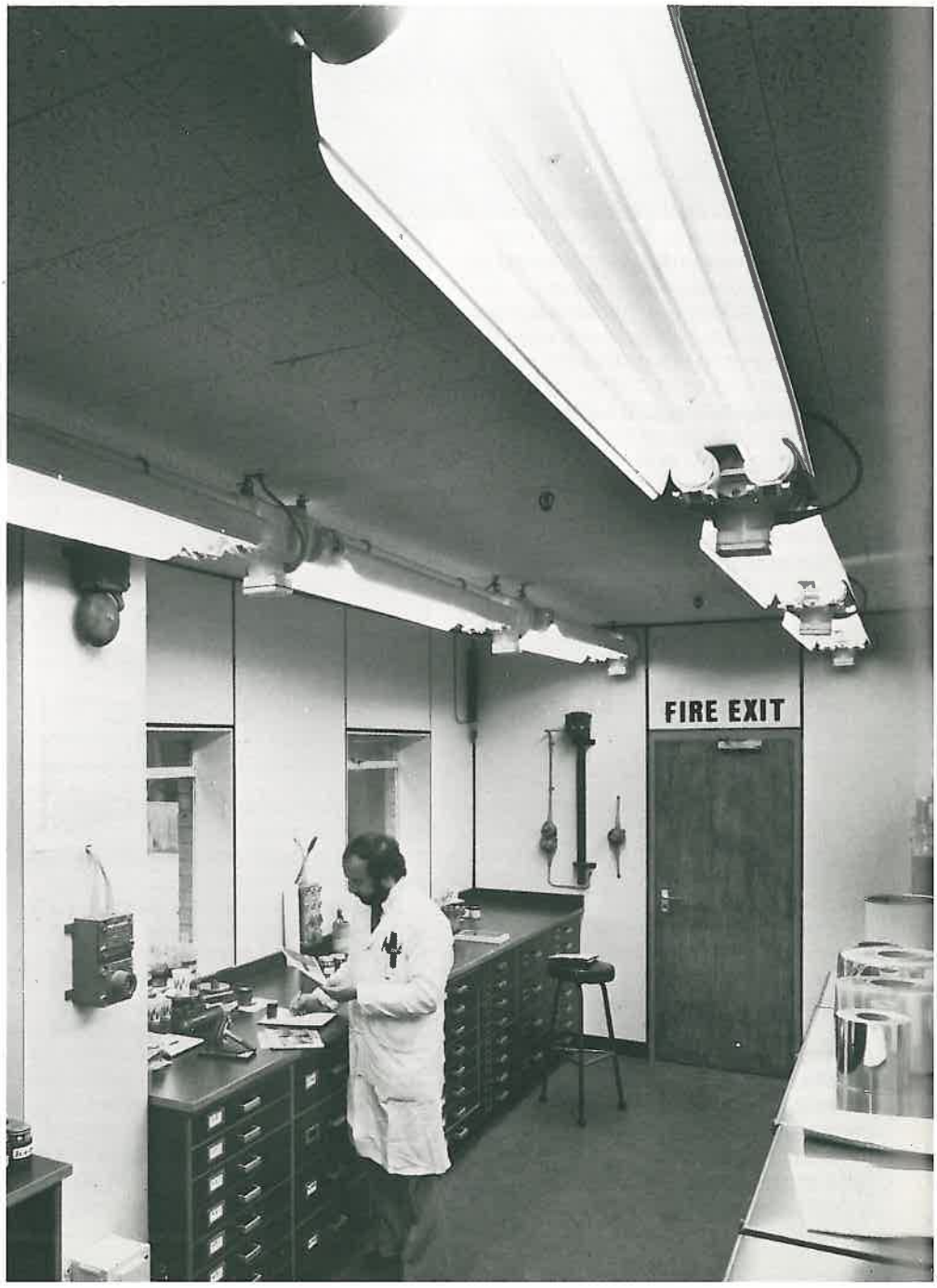
This covers a very wide range of luminaires, from those used in chemical plants to those found lighting swimming baths or used for external lighting where corrosive chemicals are present.

Two methods of protection are commonly used, one in which the normal steel body of the luminaire is given a protective coating of plastic based paint or is covered with a vitreous enamelled surface or is plated with an acid resisting metal, as in galvanising.

The second and much more satisfactory solution is to make the whole shell of the fitting of an inert material, such as glass reinforced resin plastic (fibreglass) and provide a plastic (acrylic) cover to seal the lamps and gear inside.

There is no risk of the protective surface peeling off or being abraded in a dusty atmosphere and the manufacturing process is simplified as the two components can each be moulded as an integral unit.

A type of this class of luminaire is the Thorn LU industrial fluorescent fitting. It is constructed in the manner described above with injection moulded fixing toggles securing the acrylic cover tight against a gasket; It is classified IP 23 Rainproof and has been used successfully in highly corrosive atmospheres where fittings with



Printing inks give off flammable vapours so that flameproof luminaires such as those pictured above are necessary. These are installed in the factory of the Fishburn Printing Inks Company Ltd at Watford.

surface protection have failed to stand up to test.

When seeking suitable equipment it is necessary to specify the corrosive substances, their concentration, temperature and the presence of moisture, in order to ensure that the correct material and enclosure are used.

The BASEEFA Certificate

Luminaires are submitted for approval by type test for mining use through the Safety in Mines Research Establishment (SMRE) of the Department of Trade and Industry and for general use by British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA). Since this organisation is based at Buxton, equipment carrying its approval is often referred to as "Buxton Certificated". Although such approval is not mandatory, in effect it is obligatory, as few engineers will use luminaires which do not carry the BASEEFA approval. Until recently BS 4533: Part 2: Section 21: 1969 was the standard to which luminaires were designed but this has now been replaced by BS 4533 Type N 1976.

Ignition Temperature Classification

The ignition temperature of a gas is that at which it will ignite and sustain combustion if in contact with a hot surface and as one would expect varies from one explosive mixture to another.

Town gas for example requires a temperature of 600°C (T1 Class) before it will ignite, a mixture of petrol and air about 250°C (T3 Class) while carbon disulphide has an ignition temperature of only 100°C (T6 Class).

BS 4533 Type N 1976 and BS 5345 Code of Practice both include a table of the relationship between temperature class and the maximum surface temperature of the equipment. An ambient temperature of 40°C is normally assumed when equipment is designed to operate within one of the temperature classes indicated below.

Temperature Class	Maximum Surface Temperature
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

The new Code of Practice BS 5345 includes a comprehensive list of flammable gases, vapours and liquids giving data on their temperature characteristics and this is an extremely useful guide when selecting a suitable luminaire. All luminaires will in future be marked with their temperature class but old types, still satisfactory to use, may carry the markings specified in BS 889, that is, Range X for a maximum surface temperature rise of 125°C, Y for 75C°, and Z for 50°C.

Dust Hazards

It may not be generally realised that some dusts, notably the fine dust in flour mills, are explosive and it may be necessary to use Zone 2 fittings. In any case dust should be excluded from the enclosure, as it can lead to overheating of control gear etc. Dust proof (IP 54) luminaires should normally be specified although in cases where complete exclusion of dust is essential the category should be raised to IP 64.

Although the Factory Act states that dangerous situations must not be allowed to develop, this is obviously a counsel of perfection. It is stated somewhat vaguely that equipment must be suitably enclosed in ducts and ventilation provided, but so far there is no British Standard for dust-tight equipment. Stringent requirements are laid down by the Ministry of Defence for fittings for use in situations such as ammunition factories and Part 10 of the BS 5345 Code of Practice will deal with dust hazards and is in the course of preparation.

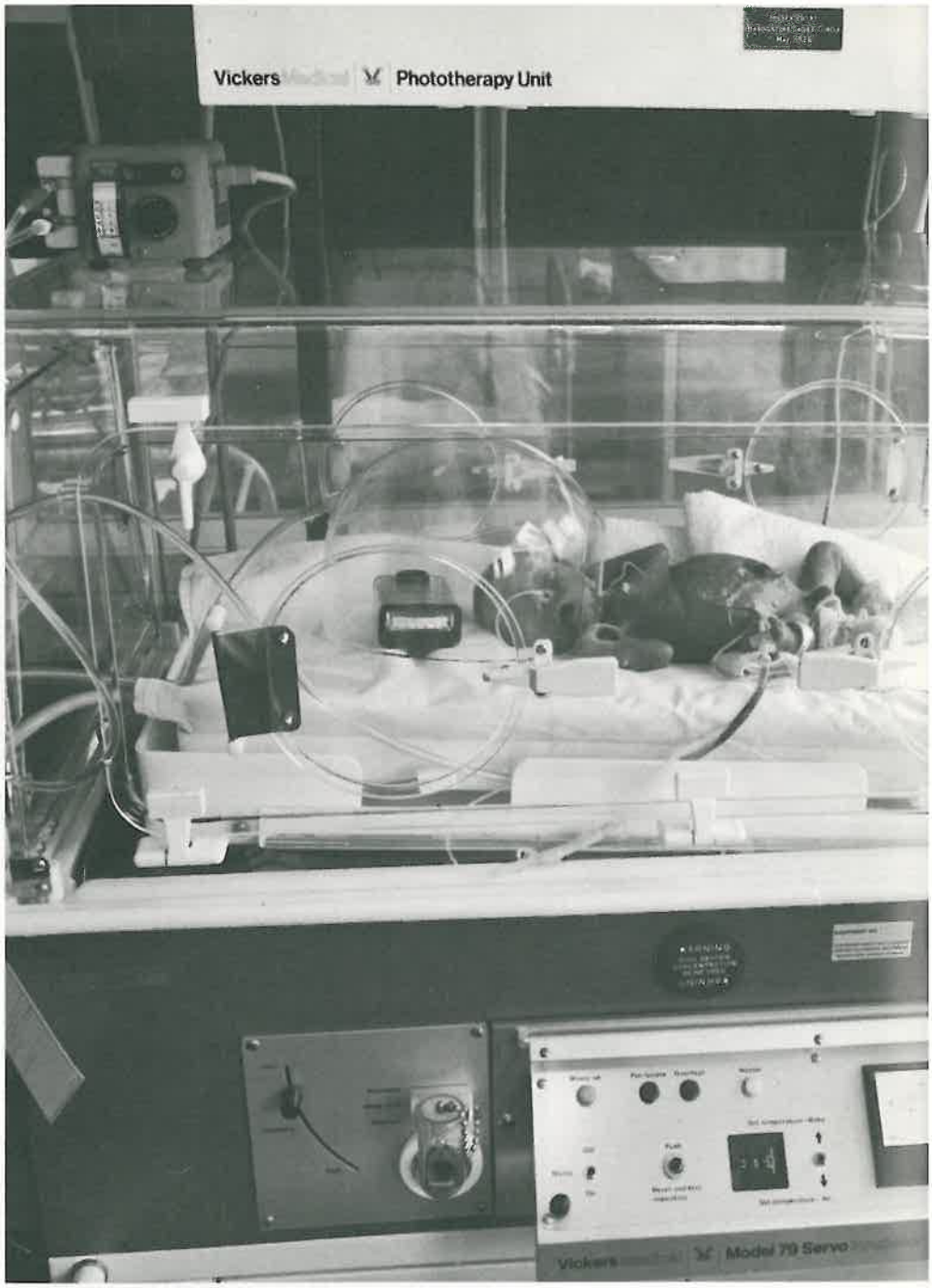
Explosive concentrations of fine dust are a hazard in mills and food factories. Here a Thorn LU fitting is used.

Light for living things

B W Jewess

Mr Jewess is engaged in colour research at the Jules Thorn Research Laboratories at Enfield

We are all familiar with the visual effect of light, that portion of the electromagnetic spectrum between 380-770nm which has the property of stimulating the optic nerves and thus enabling us to see. Light and the radiations near to it in the ultra violet and infra red regions can also affect animals and plants in many other ways, either chemically by promoting some form of synthesis or physically just by heating the absorbing body. The presence or absence of light or its spectral quality can produce periodic changes and rhythms in animals and plants, such as the day and night cycle and the yearly cycle of growth and reproduction, all to some extent triggered by light. Many plants grow towards the light, the sunflower even turning to follow the sun around, and will wither if deprived of suitable lighting. Man and many animals have instinctively exposed themselves to sunlight with no knowledge of its therapeutic properties.

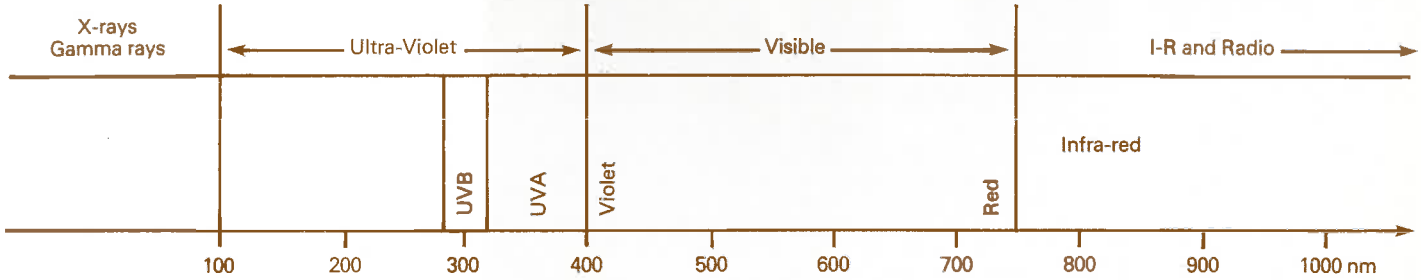


In this Vickers Medical, servo-controlled incubator a baby suffering from neo-natal jaundice is irradiated with light from "Northlight" fluorescent tubes mounted in the phototherapy unit above it.

Natural Daylight

When the natural lighting provided by the sun reaches us on the surface of the earth it has a spectrum ranging from about 280nm in the ultra violet to about 1400nm in the infra red. Artificial light sources are designed to produce visible light efficiently, but their spectral distributions are different from that of the sun. Whereas the sun has an essentially smooth continuous spectral distribution, the spectra of artificial sources can be smooth, discontinuous, monochromatic or a mixture of all three. The radiations produced by artificial light sources have the same effects, wavelength for wavelength, on plants and animals as the radiation from the sun. It is possible to reproduce the full solar spectrum of any part of it by means of artificial light sources.

Figure 1 The Electromagnetic spectrum



Part of the electro-magnetic spectrum, showing the relationship between visible, ultra-violet and infra-red radiation.

Different Types of Effect

Not all wavelengths are equally effective for most natural phenomena that are excited by radiation. These variations in effectiveness are known as action spectra, examples of which are the variation of the spectral sensitivity of the eye, erythemal effects of the ultra violet and the absorption spectrum of chlorophyll. Broadly speaking, light can affect the body in two ways, firstly by direct action and secondly by some form of photosensitive process.

Direct Effects

A common example of direct action effects is the formation of Vitamin D in the skin and the production of erythema or sun-burn both caused by radiation in the wavelength range 290-320nm or UVB region as it is called. Erythema normally appears within six hours of exposure and then slowly disappears in one or two days. Pigmentation of the skin or tanning becomes noticeable about two days after exposure and increases gradually for several days, it is caused by the melanin pigment in the skin migrating to the upper layers of the skin. It is easy to over-expose the skin when sunbathing and get serious burns, so some hotels in the United Kingdom have built solaria in which natural daylight, complete with the ultra violet content, has been simulated using discharge lamps, making it possible to sun bathe under controlled conditions in any weather.

A less well-known example of direct action is the treatment of neo-natal jaundice or hyperbilirubinemia in premature infants. Bilirubin is formed from the degradation products of red blood cells, and an excess of it in the blood caused by excessive production or failure of the liver to remove it, gives the skin a yellow colour. High concentration of bilirubin, over 15mg/100ml, can lead to permanent brain damage. The common form of treatment is to replace the whole blood with fresh blood from a donor, in bad cases the blood has to be changed more than once with all the attendant difficulties and dangers. It has been observed in the laboratory that solutions of bilirubin can be bleached by light and thus destroyed. Also it is known that infants whose cots are near windows recover from hyperbilirubinemia more quickly. Therefore it was postulated that if the infant were exposed to high intensity light, the bilirubin level could be reduced, experiments were performed and it was shown that this is so. Experiments also showed that blue light is most effective in reducing the bilirubin levels. The infant is exposed to light until the immature liver is able to metabolise the bilirubin. Blue and Northlight fluorescent tubes have been successfully used for this treatment. However there are several types of jaundice that can affect new born infants and unfortunately not all can be cured by phototherapy.

Indirect Effects

The near ultra violet region of 320-400nm called the UVA, is not considered to be particularly active in its effect on the skin and body but large doses of this radiation can cause a tan. However, if the skin has been photosensitised this wavelength region can produce erythema. Photosensitivity may be produced by certain drugs such as sulphonamides,

A sufferer from psoriasis is irradiated with light from a battery of "Ultra Violet" fluorescent lamps mounted in a special cubicle.

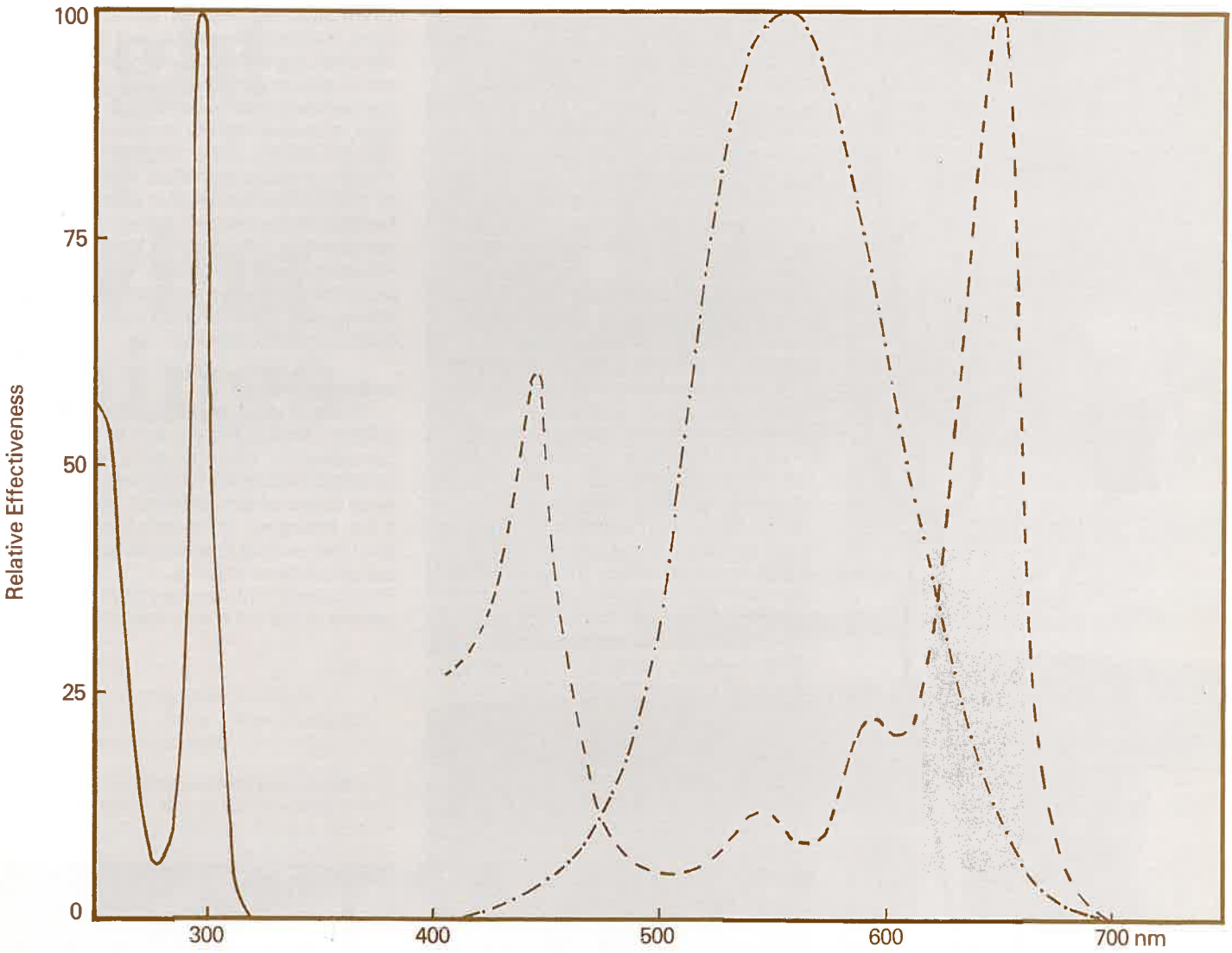


Figure 2 Action Spectra

Erythemal effectiveness
Absorbtion spectrum of chlorophyll
Variation in sensitivity of the human eye

Relative effectiveness of different wavelengths of radiation in the visible and near visible regions of the electro-magnetic spectrum.

psoralens, bactericidal agents used in soap and some topically applied creams.

An example of induced photosensitisation is in the treatment of the skin disease psoriasis.

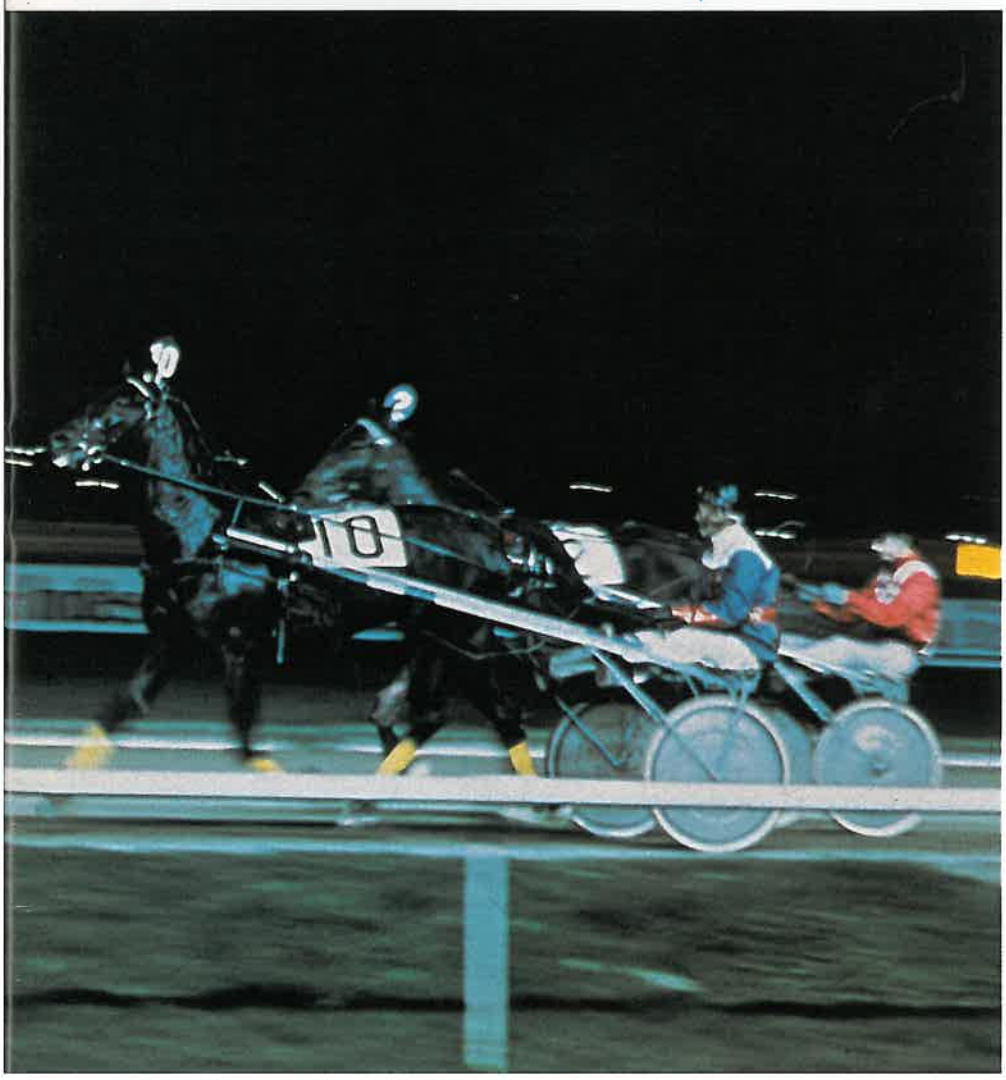
Psoriasis is a disease which affects 2% of the population. In its mild form many people are unaware that they have it, but in its worst form the whole body except the face, is covered in scaly patches. The traditional treatments required the use of tar preparations which are smelly and unpleasant to use, and bad cases needed hospitalisation. This new treatment is both clean and pleasant and can be administered on an out-patient basis. It is based on the fact that if a photosensitising drug is taken by the patient, (the drug used in this case is 8-methoxy-psoralen), and the patient is then exposed to intense long wave ultra violet light at about 350nm, provided by fluorescent lamps, the symptoms of the disease are cleared dramatically. Unfortunately this treatment is not a permanent cure, but only controls the disease; the patient needs booster treatments at regular intervals. This particular treatment is called the "PUVA" treatment from the initial letters Psoralen-Ultra-Violet-A. Another light source which has been used experimentally with success and could have a future in the treatment of small areas of the body affected by psoriasis is the Graph X 365 metal iodide lamp.

Plants

Light is an essential requirement for the growth of plants, as are temperature and humidity. The essential mechanism of plant growth is the combination of water and carbon dioxide, in the presence of light, to form carbohydrates and oxygen. An essential part in this process of photosynthesis is played by the substance called chlorophyll which absorbs energy from the sun and releases this energy for the photosynthesis process. The chlorophyll absorption spectrum has peaks at the red and blue wavelengths and a special lamp called Grolux, has been developed to match this absorption spectrum.

Plants also need periods of darkness, some requiring longer dark periods than others. This phenomena is known as photoperiodism and plants are classified as "long" or "short" night plants. The response of plants to a directional light is called phototropism, the sunflower and a species of artichoke are called "girasol" by the French for this reason. In the case of the vegetable this has been corrupted to "Jerusalem" artichoke.

It will be seen the non-visual effects of light on plants and animals are many and complex and not all are well understood. The examples quoted give no more than a general idea of the sort of problems involved, and there is no doubt that as our knowledge of plant and animal behaviour increases many other uses of radiation in and around the visible spectrum will be developed.



A Swedish trotting track

Bernth Jansson

Mr Jansson is Technical Manager at Thorn Belysning Sweden

Above: a general view of the track, showing the Floodlights mounted on the stands. The Judges' pavilion is in the foreground.
Left: competitors are well lighted, even on the far side of the track.
Inset above: An Aerial view at night.

A unique outdoor lighting installation has just been completed by Thorn Belysning at Malmo in Sweden. The Malmo trotting track is one of the largest in Europe, and it is believed that it is the only one in the World in which CSI lamps mounted on high towers have been used. The original installation consisting of lanterns mounted on street lighting poles around the outside edge of the track gave only 200-250 lux in the horizontal plane and very much less in the vertical.

Racegoers could not see the horses at all well and there were a great many accidents.

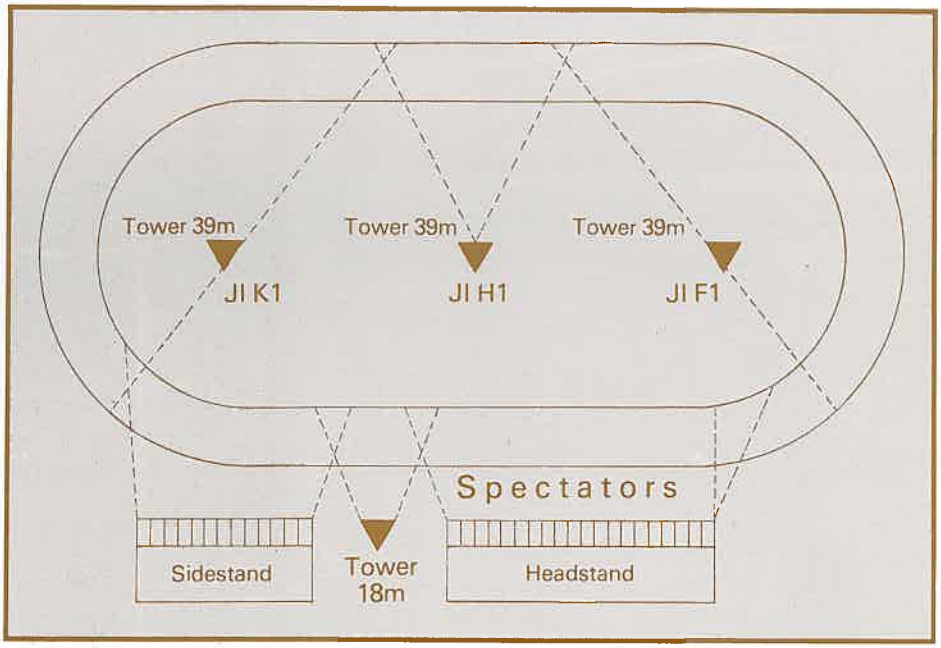
Thorns were asked to provide an installation that would give a vertical illuminance to meet Swedish outdoor television requirements and to eliminate the poles surrounding the track. It was decided to illuminate the curves and the far straight of the track by means of CSI floodlights mounted on three 39m towers standing in the centre of the arena and provide the extra powerful lighting required in the home straight and at the winning post from MBIL lamps in ON 1600 floodlights mounted on the roof of the stands. The problem was somewhat simplified by the fact that the stands for spectators were, as is usual in race tracks and trotting tracks, all on one side of the arena, so that the floodlights could be aimed away from the spectators.

Lighting Requirements and planning

The area covered by the track is about 26,000m² the track itself being 1,000m long and 25-27m wide. The average horizontal illumination was planned to be 350-450 lux and the vertical from 750-1,000 lux to give good visibility both to spectators and for the television cameras. The customer finally decided on an average vertical illuminance of 750-1,000 lux on the home stretch and at the winning post and 450-600 lux on the curves and the straight at the far side of the course.

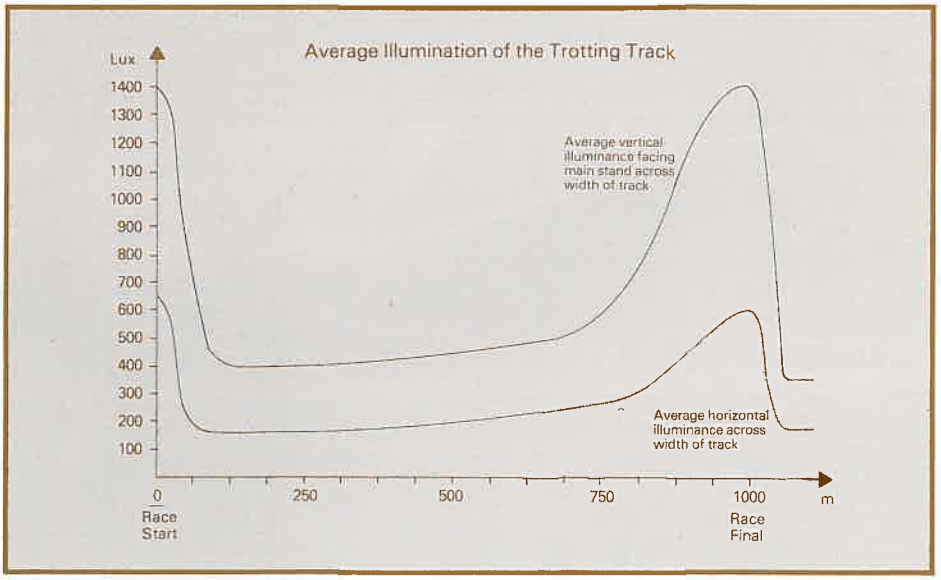
The installation was planned with three 39m towers equally spaced in the centre line of the course and an 18m tower between the two stands. A total of 209 CSI floods were mounted on the headframes of the three central towers; most of these were aimed at the distant stretch, but a few were aimed to light the off-side of the home stretch so that the umpires could see the horses' numbers. The ON1600 MBIL floodlights were mounted on the roofs of the two stands and on the lower mast in such a way that the illuminance gradually increased towards the winning post.

The total number of floodlights of both types is 362 and the total load about 540kW. The customer decided to accept the scheme and Thorn Belysning was appointed the general contractor with local building and electrical sub-contractors.



Location of Floodlights	No.	Type	Lamp Loading	Where aimed
Main Stand	88	ON1600	1600W	Home Straight
Side Stand	44	ON1600	1600W	Home Straight
18m Tower	21	ON1600	1600W	Home Straight
Tower JIF1	72	CSI	1000W	Far Straight and Second Curve
	9	CSI	1000W	Back Lighting*
Tower JIH1	37	CSI	1000W	Far Straight
	5	CSI	1000W	Back Lighting*
Tower JIK1	80	CSI	1000W	Far Straight and First Curve
	6	CSI	1000W	Back Lighting*

*For Home Straight



The graph shows how the horizontal illuminance is gradually increased towards the winning post.

Installation

The installation was made in five steps:

(1) Installation of new main voltage switchgear.
(2) Installation of floodlights on the roofs of the stands.
(3) Erection of control-gear houses for the three high towers.
(4) Erection of the towers complete with floodlighting equipment.
(5) Installation of the tower between the stands.

A complete mains voltage switching and supply installation was designed and installed, terminating at distribution boxes in cabins at the foot of the towers and on the roofs of the stands. The lighting for the straights was switched on in four steps. Each of the floodlights on the stands was provided with its own control gear box, they were mounted on steel girders along the front edge of the roof and each was separately fed and fused from a distribution box; two of which were mounted on the main stand and one on the other. Automatic time relays were provided for switching on the floodlights.

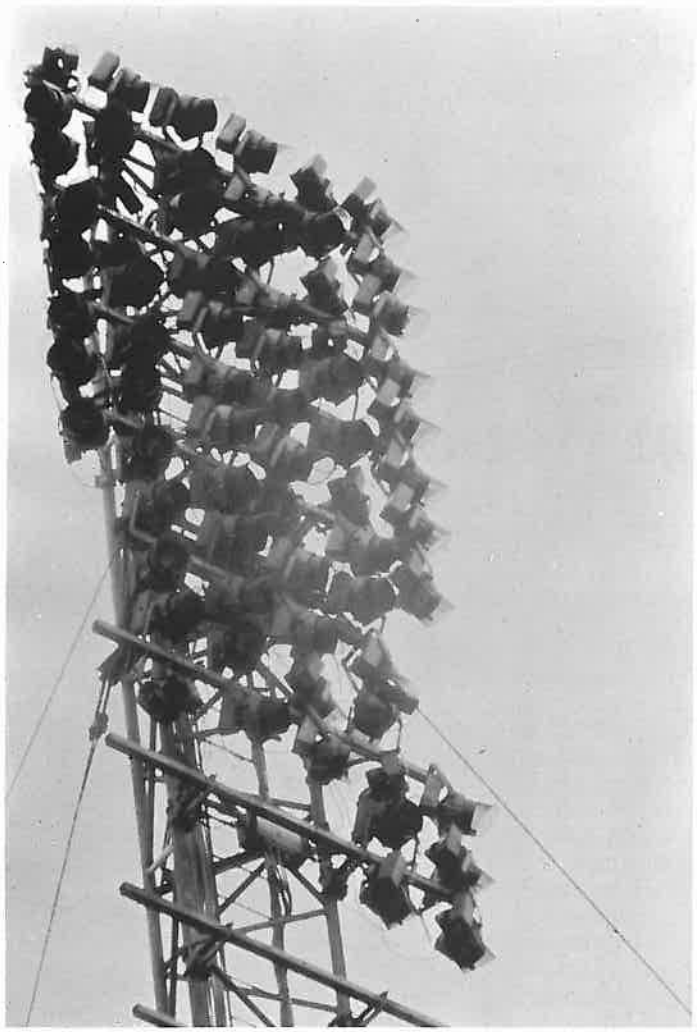
The erection of the towers was carried out in two stages. First an 18m stage was erected while the floodlights were attached to the headframes on a second section at ground level. The entire assembly was then hoisted into place by means of a crane and the two sections of the tower bolted together. The towers are of triangular lattice construction guyed on four sides. After they were erected, the electrical contractor connected the floodlights to the control gear in the prefabricated gearhouses at the foot of the towers. A similar technique was used for the shorter towers between the stands.

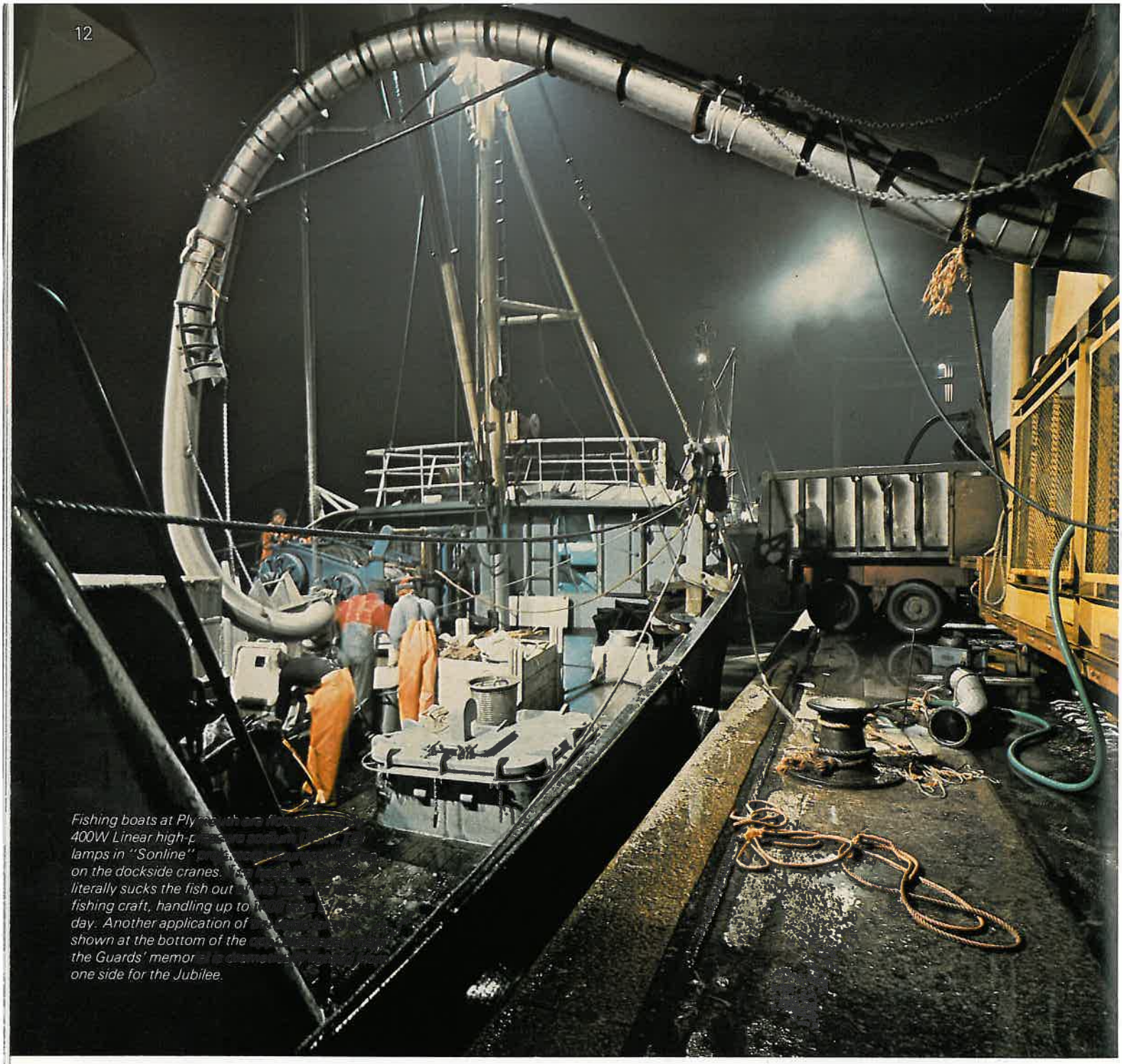
Aiming the Floodlights

Aiming was undertaken over a number of nights, with one man at the floodlight and two checking at marked positions on the track. They communicated by "Walkie Talkie" sets. The vertical and horizontal illuminance was measured at 1.2m above ground level at 640 points distributed over the whole track. During the aiming considerable glare was complained of by the inhabitants of a small village close by and on some of the surrounding roads but this was substantially reduced by the use of glare shields.

The average illuminance on the final straight was 445 lux in the horizontal and 1115 lux in the vertical plane, and on the far straight and curves 220 lux and 460 lux on the horizontal and vertical planes respectively. The graph shows how the illuminance, a little below average at the starting point was gradually stepped up to a maximum at the winning post. The completion of the installation is now going forward and will provide a vertical illuminance of from 750-1000 lux over the whole track, completely adequate for television. The total electrical load is in the region of 540kW; the four-stage switching arrangement allowing the illumination to be reduced by 50% between races effecting about a 20% annual saving in running costs. The new lighting system is one of the most up to date in the world providing excellent viewing conditions for spectators and television cameras and much reducing the risk of accidents on the track.

Below left: A headframe showing the diverse aiming of the CSI floodlights on the high towers is shown above, below is a headframe complete with its load of floodlights is being hoisted into position.





Fishing boats at Ply... 400W Linear high-p... lamps in "Sonline"... on the dockside cranes... literally sucks the fish out... fishing craft, handling up to... day. Another application of... shown at the bottom of the... the Guards' memor... one side for the Jubilee.

Some thoughts on floodlighting

D C T Brooks

Mr Brooks is Senior Product Executive for Outdoor Lighting Equipment at Thorn House, London.

Many people associate the word floodlighting with football and it is no secret that Thorn Lighting have been very successful in selling floodlighting schemes to most of Britain's major football clubs. Our prestige in lighting sports and football stadia is world-wide and the ability to provide high quality floodlighting schemes to meet the most vigorous specifications has enabled us to win contracts in the face of the toughest international competition. Lighting football grounds is certainly a fascinating and dramatic technical exercise, but it is perhaps more important as a shop window to encourage the use of floodlighting equipment in industry, commerce and the leisure industries.

The introduction of the 1500W MBIL lamp (derived from the earlier 1600W version, which has been used with such success in lighting sports stadia) has allowed the size, the weight and, perhaps most important of all, the cost of the control gear to be reduced; ultimately providing a reliable lamp of longer life. Its use has thus been extended to a whole range of large area lighting schemes. Already, we have seen MBIL used for lighting major construction sites and ship yards, for example the Port of London Authority have installed a major scheme of 1500W lamps used in ON 1600 luminaries for their dock complex at Tilbury. Industrial floodlighting is an area of major importance and growth and the large lumen package, of the MBIL lamp in a relatively small luminaire, is an important tool in industrial as well as stadium lighting.

In the current economic climate, Britain can no longer afford to stop working every night, but the high energy costs brought about by this same economic climate mean that some may question the cost-effectiveness of exterior lighting. Exterior lighting is economically viable however, and few industrialists can afford to ignore the contribution that it can make in three vital areas: efficiency, safety and security.

Both the busy marina at Sutton Harbour, Plymouth, from which Drake sailed, and the gate of Macfisheries' depot at Frimley are lighted by high-pressure Sodium lamps. In the former they are SON.TD lamps housed in Sonline projectors, in the latter ordinary KolorSON lamps in Area floods.

Efficiency

There are still many industrial working areas where work could continue after dark, thereby contributing greater efficiency and productivity if only suitable lighting was available. Expensive plant and facilities lie idle for lack of efficient lighting. In many industrial estates rusting and ageing floodlights with high wattage GLS lamps are still being used. Street Lighting Authorities have recognised the waste of energy, represented by 150W GLS installations for example, and have instituted major replacement schemes over the last year or two, switching in this instance to the more economical 35W SOX Beta 5 lanterns (Lighting Journal Issue No. 15). On the other hand, there are still many installations in the private sector and on industrial sites where this type of economy is not being achieved. Wise investment in efficient floodlighting can prove to be a valuable asset to any company.

Safety

Not only can work continue with well planned exterior lighting but it will do so in relative safety. In recent years, legislation for safety at work and for safety of electrical equipment, has been introduced, as for example, the Health and Safety At Work Act 1974 and Electrical Equipment (Safety) Regulations 1975. Lighting itself can be regarded as a safety device. Not only must dangerous places be illuminated but the equipment which provides that illumination must be designed to be safe for installation and operation.

The BSI safety-mark gives an independent assurance to all concerned that lighting equipment has been designed and made in accordance with good engineering practice and that it has been type tested and complies with BS4533. Moreover, it ensures that its manufacturing quality has been maintained regularly by inspectors of the British Standards Institution on behalf of their Quality Assurance Department.

Well lit premises assist security personnel and serve to deter crime. The role of floodlighting and street lighting as a security weapon is well established and its use is supported by statistics for accidents and crime. During the period of the enforced "blackouts" 1973/74, an overall increase in crime was reported by various Police forces throughout the country with increases in excess of 50% being commonplace for many categories of crime, and with the implementation of 50% cuts in streetlighting, accidents on the road rose too. The implications are two-fold. First of all, the statistics demonstrated very clearly the importance of lighting from both a security and safety point of view and secondly they focussed attention on the need to provide efficient, energy — saving equipment to provide that light. All premises have some risk of being robbed, attacked by vandals or set on fire and this is increased during the hours of darkness. The provision of lighting helps to reduce that risk, but to be effective it needs to be well planned and designed to suit the particular location. Exterior lighting primarily intended for a specific work task will provide an added bonus of security, but where security lighting is itself the prime task it works best when designed as part of a complete security system including physical defences and a good standard of supervision.

Some examples of power savings that can be achieved in outdoor lighting streetlighting

Light source	Replace by	Power Saving	Light output
150W GLS	35W SOX in Beta 5*	65%	+120%
250W MBF	90W SOX in Alpha 1 or Alpha 9	36%	+4%
125W MBF	70W SON in Precinct*	36%	−4%

*also available in other luminaires

Floodlighting

Light source	Replace by	Power Saving	Light output
250W MBF	150W SON in Area Floodlight	36%	+12.5%
1000W tungsten halogen	250W SON-TD in Haline	71%	+19%
1500W tungsten halogen	400W SON-TD in Haline**	69%	+39%

**also suitable for ON1600

NOTE: Light output data is based on relative lighting design lumens.

Economy

In Area Floodlights, the use of 250W or 400W high pressure sodium lamps is already firmly established and this source is becoming more popular than mercury. The similar ratings of SON-TD lamps in the Haline floodlight are rapidly gaining ground too. The slim lamp enables good optical control from a smaller luminaire (see Lighting Journal 17). It is quite easy to demonstrate that the higher capital cost of equipment compared with tungsten halogen, can quite quickly be recovered, due to lower power consumption and running costs. Discharge lamps and in particular high pressure sodium, are more economical than their incandescent counterparts and have a very much longer life. These arguments are becoming most persuasive to the user as he can look forward to reduced electricity charges, less frequent re-lamping and yet be secure in the knowledge that for this capital investment his premises are well lit for work and security. The slightly higher initial investment in equipment for discharge floodlighting will give a rapid pay back period particularly in situations where the system will operate from dusk to dawn throughout the year. The reduced risk of crime against his property will be reflected in insurance rates which in todays cost conscious climate, are factors difficult to ignore. The range of SON lamps has been extended by the introduction of a 70W version and a 150W version. There is little doubt that this light-source is becoming increasingly important for exterior

lighting as it has a pleasant golden white colour, high efficiency and a high degree of reliability. Thorn SON lamps now provide efficient counter parts to MBF across a wider range than before.

Low pressure sodium has also demonstrated considerable growth. Where colour is not critical — as in many street lighting systems, the lamps' high efficacy and low power consumption have given Local Authorities an incentive to undertake extensive programmes to switch to this light source. This thinking is equally applicable to private service roads and factory areas. Changing from 150W GLS to 35W SOX gives an immediate saving in power consumption of 98W and an improvement in lamp lumens from 2060 lm to 4300 lm. (See table opposite) A similar case can be put forward for changing 250W MBF systems to 90W SOX.

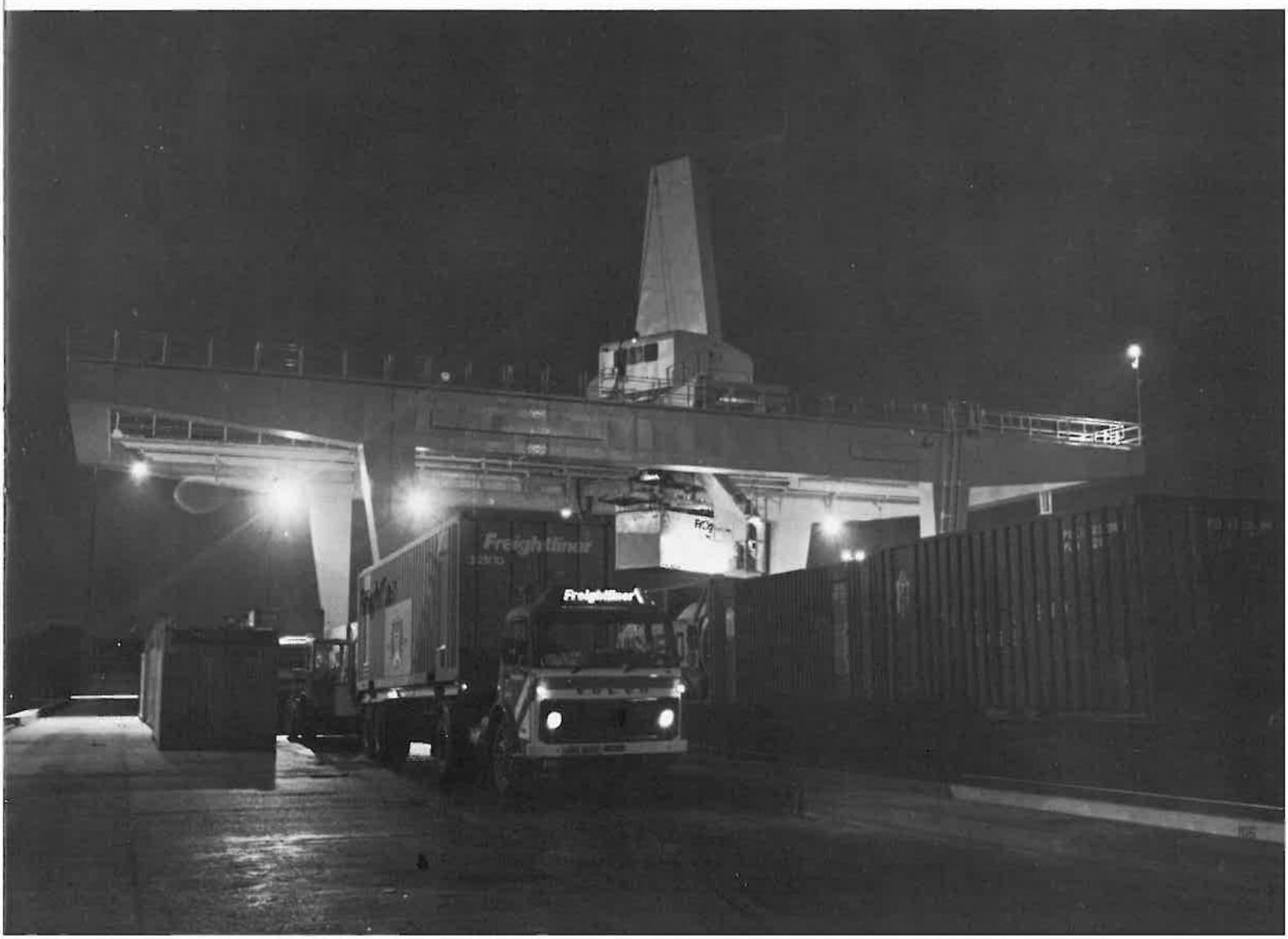
But whilst, for economy of operation, particularly for longer burning hours, the emphasis must rest firmly with discharge, we must not forget the tungsten halogen lamp which has become such an excellent means of providing floodlighting schemes at low capital cost. Sunfloods are extensively used to provide low cost general area floodlighting for car parks, work areas, gardens, forecourts and even for domestic use. Tungsten halogen is also well suited to security situations where an instant flood of light, for checking purposes at a gatehouse for example, or where only occasional use of the system, is demanded. The asymmetric distribution produced by the Haline, provides an excellent method of floodlighting buildings, work sites and building sites, security installations and a wide range of similar applications. It is suited to upward aiming too and the range of luminaires uses a common optical system with the facility to provide for tungsten halogen lamp ratings from 300W to 2000W. The world wide use of Haline whether illuminating beaches in Spain, buildings in Iran or used industrially in Britain, testify to its acceptability.

Single-ended mains voltage 300W and 500W tungsten halogen lamps, have enabled a narrow beam floodlight using a parabolic reflector to be produced. This floodlight, known as Sunspot, uses a PAR 64 front glass to produce a narrow beam suitable for lighting features such as signs, flags, statues or clock faces. A wider beam spread can be achieved by a change of front glass but still retaining the same lamp(s) — namely 300W (M38) or 500W (M40).

Exterior lighting can be a benefit to the leisure industry too. A brightly lit pub or hotel will attract passing customers and enable them to see clearly to park their vehicles and deter damage or theft against these vehicles. Sports and leisure centres can extend the use of their facilities, particularly in the popular early evening period. The use of 1500W MBIL is rapidly becoming an obligatory requirement for many local rugby and football clubs who wish to maximise the use of their grounds and club facilities. Leisure, in fact, is a business where cost-effective floodlighting has frequently proved to be a valuable investment.

Because life must and does go on after dark for work and play — then Thorn Lighting will be there to "hold back the night."

400W Sonline (SON.TD) lamps were substituted for tungsten halogen lamps in the Haline fittings on the Goliath cranes at Stratford Freightliners terminal resulting in an energy saving of around 66%.



Lighting for the Jubilee

Here we see above, the Thorn floodlighting of ICI and Thames House near Lambeth Bridge, in which SON TD lamps provided the main lighting and salient decorations were picked out by Sunspots. One of the 400W CSI lamps used to pick out Nelson on his column being installed in the existing searchlight projector instead of a 1000W projector lamp. (See our cover picture) is shown below.

In the bottom right hand picture the spires of Lichfield Cathedral are picked out by high pressure Sodium lamps, with mercury lamps shining through the windows in the central spire, and the scene at the end of the Thanksgiving Service at St Pauls, lighted for television by Thorn CSI lamps mounted on the galleries below the clerestorey windows can be seen to the left of it.

Techniques of luminaire manufacture

L W V Turner

Mr Turner is the Chief Engineer of Smart and Brown's Factory at Hereford.

Above: The new Foundry at Hereford is a light and airy place on which MBIF lamps in Hipak fittings cast a clear cool light. Opposite can be seen the glass-fibre press which moulds the outer covers of non-corrosive luminaires at the rate of twenty to thirty an hour.

Luminaires have been manufactured for many years at the Smart and Brown factory at Rotherwas, Hereford, but prior to 1977 the factory was on two sites separated by a public highway. The latter part of 1976 and the first half of 1977 saw a relocation and consolidation of all manufacture on the one main administrative site giving increased efficiency and a reduction in overhead costs. The moves culminated in the completion of a modern aluminium foundry which was formally opened by Sir Richard Cave on 5th April this year.

The New Foundry

Most people think of a foundry as a dark, dirty and noisy building filled with smoke and lurid with bursts of flame into which natural daylight can scarcely penetrate and lighted by dimly seen lamps mounted high in the smoky ceiling. The new foundry is a light and airy building, with excellent daylighting and the minimum of smoke and gloom. Its total floor area is over 2000 square metres, nearly twice the size of the old foundry, and it is lighted to give a general illuminance of 500 lux. An experiment carried out in the old foundry determined the choice of lamp. SON lamps were first substituted for the MBF lamps then in use, but although the amount of light was increased, the change in colour appearance, particularly of the molten aluminium, caused great difficulty amongst the foundry men. The experiment was continued for a while but finally terminated in favour of MBIF. The metal halide lighting in the new foundry has been well received.

The advantages of die casting

LM6 aluminium ingot has increased in cost by 270% over the last four years and this cost increase has led to a more economic use of the material in the form of pressure die-castings for certain luminaires rather than gravity die castings. The Beta 5 street lantern provides an interesting study of what has been achieved in this direction. As a gravity die casting, the canopy used to weigh 1.8 kilogrammes but the present pressure die casting has reduced this to 1.31 kilogrammes, a metal saving of 28%. Also the faster production rate of pressure die casting has led to a saving of 54% in the time cycle of casting and fettling.

The latest and most sophisticated pressure die casting machine just installed is a 400 tonne Swiss made machine. This machine is fitted with automatic die lubrication and automatic ladling, the whole cycle being controlled by an electronic control panel. When the two halves of the die are opened by the machine the automatic lubricating head descends between them, blasts air to remove any metal particles and then lubricates both halves. It then retracts, the die closes and the automatic ladle feeds a measured quantity of molten aluminium into the machine. The whole cycle of events takes approximately 1 minute thus providing a production of 60 castings per hour. The next stage of development is automatic extraction of the casting from the die at the end of the cycle.

At present a range of pressure die-casting machines are installed ranging from the smallest one with 110 tonnes locking force to the largest 400 tonne machines and there is sufficient space to accommodate more machines. Since it is not always economical to use pressure die castings, gravity die stations are available. The new Morgan IC 750 furnace helps to melt an annual quantity of approximately 800 tonnes of aluminium ingot, a raw material worth about £½ million at present costs. It can be fired by either gas or oil as economics demand.

Drilling and tapping an aluminium casting in a dual operation by one operator.

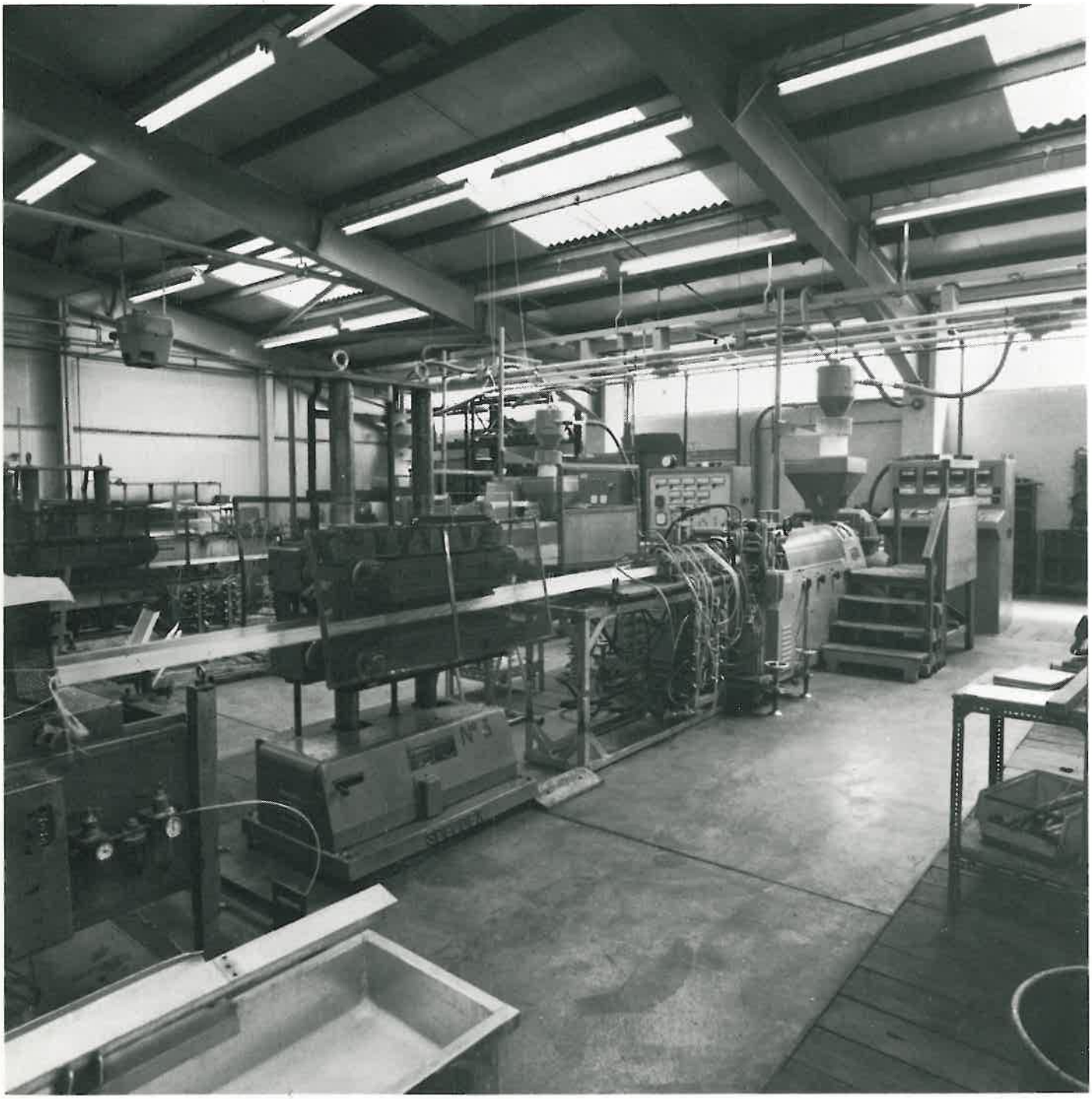
Sophisticated machining of castings

Adjacent to the foundry is the machine shop dealing mainly with drilling and tapping operations of castings. High volume output of castings has necessitated the development of specialised equipment to handle the components quickly, accurately and economically, and this has been carried out within the factory, specialised jigs and tools being designed and made to allow a number of processes to be carried out in a single operation. Much use has been made of automatic air operated drilling and tapping heads of the Desoutter and Ingersoll Rand type mounted in clusters in order to reduce machining time cycles. In the photograph one man operates both a drilling machine and a tapping machine in sequence.

Glassfibre Manufacture

In contrast to aluminium, the cost of glass reinforced plastics (GRP) has only been doubled. This makes it a possible material to be used instead of, or in conjunction with aluminium and it has the further advantage of being light in weight, having a specific gravity of 1.8 compared with 2.6 for aluminium. It also possesses excellent corrosion resistance in its natural finish, so that luminaires need not be painted; a very important consideration. It will be clear that protective paint or plastic finishes applied to a luminaire can be scratched or abraded to expose the metal to corrosive atmospheres, but making the whole outer shell of a corrosion-resistant material overcome this difficulty. This has been borne out in practice: as may be seen in the use of Thorn Area Floods in an exceptionally severe condition at Sandviken, in Sweden *(Lighting Journal No. 13)*. The manufacturing cost is also reduced as any coloured pigment can be incorporated in the material. Used with aluminium castings, as for example in the Alpha Six street-lighting lantern, GRP will provide low weight for large areas and the aluminium extra rigidity and higher thermal conductivity where necessary.

GRP arrives at Hereford in the form of a mat or blanket of glassfibre preimpregnated with polyester resin and fillers combined to produce a



mouldable material under the influence of heat and pressure.

Three moulding presses are currently installed, they include British and Swedish 500 and 600 tonne machines and have heated plattens onto which the moulds are fastened and by which are brought up to the required moulding temperature of typically 135°C.

The GRP material is carefully cut into precalculated sizes and weighed before being placed in position on the lower half of the steel mould. Press closure at approximately 15 N/mm² pressure will produce a moulding in a 2½ minute cycle. Immediately after removal from the press, the component will have any "flash" removed before being clipped on to a cooling jig in order to ensure a true moulding when cold. Depending upon the design of the moulding, holes can be drilled using automatic air operated drilling heads, the operator doing this during the press moulding cycle.

The extrusion of plastic lighting controllers is carried out by this machine. Plastic granules are fed into the hopper on the right, melted and extruded in a continuous ribbon which has a prismatic pattern imposed on it and is bent into shape while it is still hot and is finally cut into lengths to suit fluorescent fittings.

Plastic Extrusion

Over 1300 tonnes per annum of plastic extrusions in styrene, acrylic and PVC are manufactured from a range of extruding machines. A typical installation of extruding equipment is illustrated. At the head of the extruding line is the electronic control panel governing speed and temperature. Power for the extruding head is supplied by a 30 HP electric motor. Plastic granules are fed into a hopper above the extruding head by means of a piped supply from a main bulk store and from there into the heated extruding head. Extruding temperatures are between 150°C and 160°C depending upon the section being extruded. The extruding screw in the head forces the heated plastic to the head exit to which the extruding die is attached. For diffuser sections of

prismatic form, the die will be of the required profile and contain the longitudinal prisms. Transverse prisms are rolled into the base of the diffuser immediately after the plastic leaves the die before it has cooled and while it is still soft. Air cooled formers then give a final shape to the section while it is cooling. A caterpillar system assists in hauling the extruding section from the diehead to the circular saw for cutting to length. The cut length is controlled to within ± 1.5 mm by a photoelectric cell.

Another extruding machine is employed solely for the manufacture of patterned acrylic sheet used for the forming of diffusers for LU type luminaires. Immediately after issuing from the die head the hot sheet is passed through very highly polished rollers and a patterned roller and is automatically slit and cut into the required diffuser blank size ready for forming. With the installation of the sheet extruder, and together with the progress in glassfibre production it has become possible to manufacture virtually all the LU luminaire components at Hereford at a substantial saving in cost, rather than import them from the continent.

Assembly, Inspection and Test

Most luminaires are assembled by teams of 8 people associated with a conveyor belt for transferring the work from one person to another, although assembly is carried out on static benches for the smaller quantity batches.

All luminaires are inspected and electrically tested, in order to maintain a high quality standard and ensure correct functioning in a safe manner. Quality is monitored by an independent and continuous daily quality audit process and also by a quality appraisal system in association with the Standards Engineering of Thorn Lighting at the Jules Thorn Research Laboratories at Enfield.

Conclusion

The techniques described above have resulted not only in the reduction of manufacturing costs, greater accuracy and greater speed in production, but in the availability of very high quality floodlighting and streetlighting products at a competitive price for the user. A side effect has been the provision of pleasant working conditions which, by reducing strain on operatives contribute towards the reduction of spoilage and to satisfactory labour conditions.

Top left: In the assembly shop fittings are passed from one operative to another on a conveyor belt, as each stage of assembly is completed. The picture opposite shows the final testing of an Alpha 7 street lighting lantern.

Chemistry at Leicester

V Goddard

Dr Goddard is Principal Chemist in the Lamp Research Laboratory at Leicester

This article is the second in a series illustrating the work of the Thorn Research Laboratories. Dr Goddard describes how modern analytical techniques can assist in solving lamp problems and sometimes result in the production of improved light sources. The range of support available to the lamp engineer is an important factor in maintaining the quality of various types of lamp.

Above: The combined scanning electron-microscope and energy dispersive X-ray analyser system. The yellow dome contains liquid nitrogen used to cool the X-ray detector to −196°C.
Left is an atomic absorption spectrometer fitted with a carbon furnace flameless atomiser, capable of attaining temperatures in the order of 3000°C.

The Chemistry Group at Leicester has two main functions; to provide analytical support facilities to the laboratories and factories and to conduct basic research into the areas of chemistry that are relevant to the production of present and future light-sources.

The former activity, which is the subject of this article, involves the chemical analysis of lamps and lamp components, including such items as the identification and measurement of filling gases and the detection of gaseous impurities in lamps. Problems which may give rise to lamp failure or reduced light output such as the presence of unspecified chemicals in components and the characterization of stains and deposits on bulb walls are also investigated.

Mass Spectrometry and Gas Liquid Chromatography

The identification of gases is carried out either by mass spectrometry or gas liquid chromatography, two techniques which tend to complement one another. Mass spectrometry is ideally suited to the detection of impurities in the gas in the range 1-1000 parts per million, whereas gas liquid chromatography is more suited to giving high precision for major constituents. Gas liquid chromatography can be used for the detection of traces of inorganic gases (using a thermal conductivity detector) but its detection limit is in the range of 10 to 100 parts per million, although under certain circumstances this can be reduced to one part per million. It has been used to determine the level of water vapour in a GLS lamp by using a technique involving the concentrating of water vapour in acetone. A typical chromogram is shown below. Levels of water vapour up to about ten parts per million in the lamp fill are acceptable but above this level its presence results in the lamp having a sooty appearance and reduced life.

Water is also undesirable in discharge lamps. When the lamp is running, water in the arc tube dissociates to hydrogen, which can cause severe starting problems. The quantity of hydrogen present can be estimated by mass spectrometry. A combination of inert gas fusion and gas chromatography is used as an extremely sensitive method of estimating the amount of oxygen and water present in metal halide compounds before they are dosed into lamps. The apparatus uses an electronic zirconia cell as detector and is capable of measuring levels of water and oxygen as small as one hundred millionth of a gramme. This assists in minimising the water vapour in the lamp, where besides the possible hydrogen production, any liberated oxygen causes erosion of the electrodes.

Atomic Absorption Spectrometry

Atomic absorption spectrometry is extensively used in the laboratory. This technique is capable of analysing almost all the metallic elements, and there are over 70, at the parts per million level and below. Among the numerous applications of this technique is the analysis of tungsten filaments for the presence of elements such as iron, nickel and potassium. The iron content in the tungsten wire used in halogen lamps is particularly important as it will diffuse out of the tungsten during lamp life and combine with the halogen in the gas phase. The vapour pressure of iron tribromide and iron triiodide is such that they tend to condense in the colder regions of the lamp and thereby remove halogen from the tungsten-halogen cycle. Iron levels are usually in the 10 to 20 parts per million range and an increase of as little as five parts per million can have a significant effect on lamp life if additional halogen is not included to compensate for it.

Atomic absorption spectrometry has also been used to study the effect of impurities on the ultra-violet transmission of the fused quartz tubes used in high-pressure mercury lamps. These can cause colouration of the quartz arc tube which absorbs the ultra-violet radiation produced by the discharge, thereby reducing the light output. Impurity levels as small as two parts per million can make the tube unacceptable for lamps.

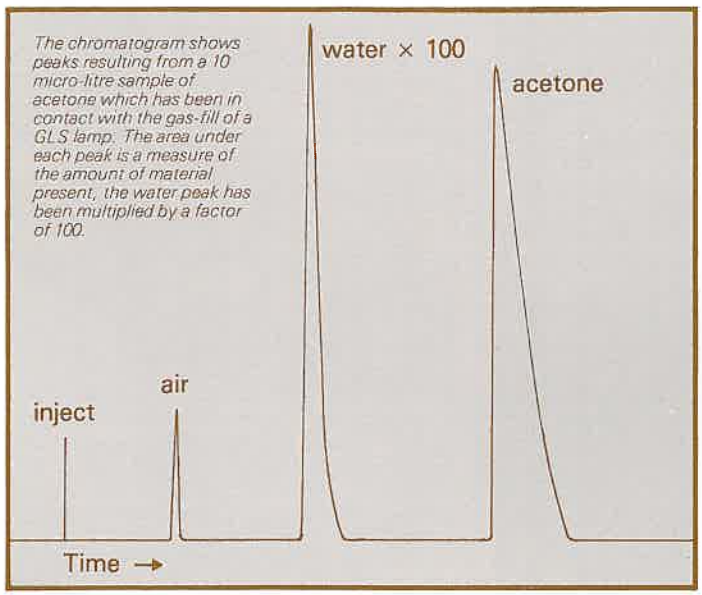
The life of high-pressure sodium lamps can be substantially reduced by the presence of minute quantities of undesirable materials in the alumina arc tube, making it become porous. Atomic absorption spectrometry is employed to determine levels of impurities in the high-purity aluminium powder used in the production of these tubes.

One of the atomic absorption spectrometers is fitted with a carbon furnace flameless atomiser. This vaporises the atom in which we are interested by the resistive heating of a carbon tube instead of using the more conventional flame vaporisation technique.

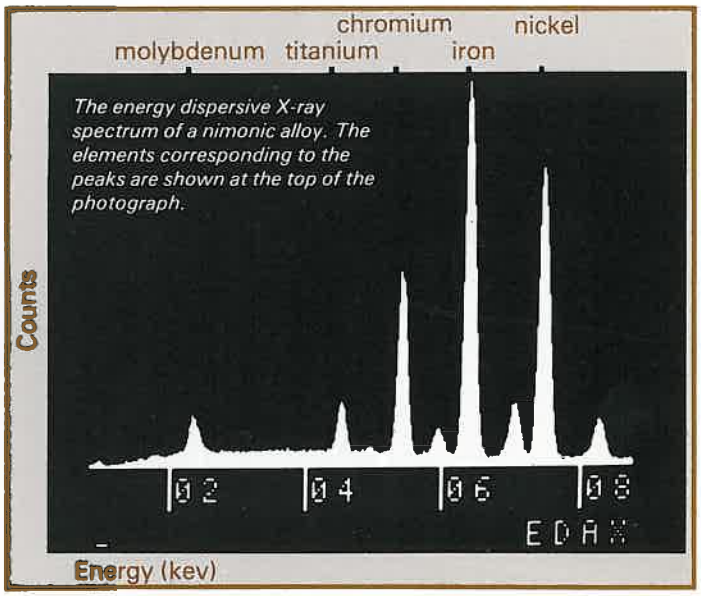
Because this needs a much smaller volume of solution than the flame technique it is possible to detect some elements at the level of one million millionth of a gramme. This technique is ideally suited to the quantification of minute stains on the walls of bulbs and arc tubes.

The study of pollution

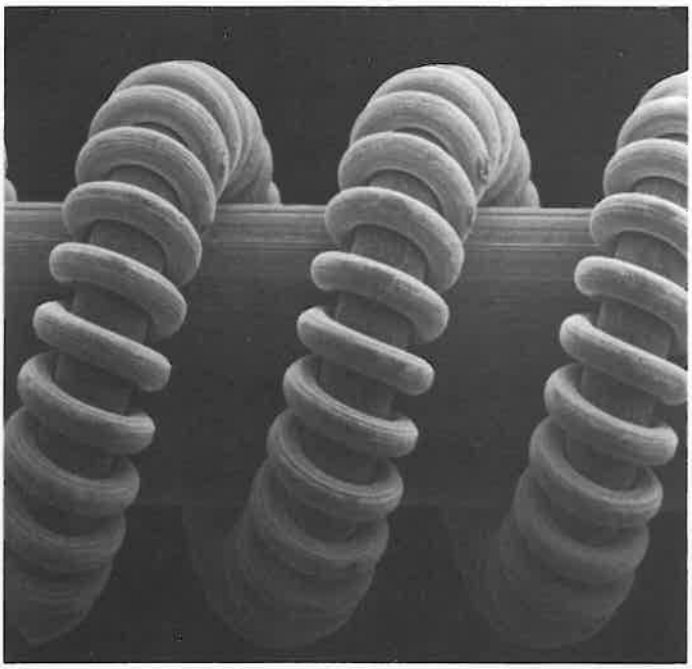
With the advent of stringent environmental legislation the laboratory is frequently requested to

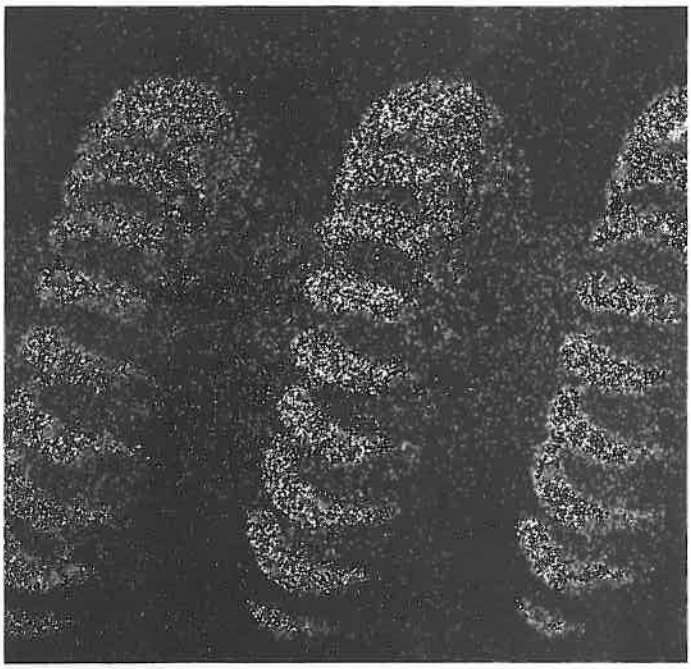


The chromatogram shows peaks resulting from a 10 micro-litre sample of acetone which has been in contact with the gas-fill of a GLS lamp. The area under each peak is a measure of the amount of material present, the water peak has been multiplied by a factor of 100.



The energy dispersive X-ray spectrum of a nimonic alloy. The elements corresponding to the peaks are shown at the top of the photograph.





The scanning electron micrograph of a coiled-coil tungsten filament. The left-hand photograph shows it coiled on the secondary mandrel and magnified about 200 times; in the X-ray image on the right, the tungsten appears as an array of bright dots.

undertake studies of possible atmospheric and effluent pollutants. These are invariably in the 0.01 to 100 parts per million range and therefore when practicable atomic absorption spectrometry is ideally suited to their analysis. Where this is impossible, some elements, such as the halogens and sulphur can be analysed at the parts per million level by using ion selective electrodes. These electrodes allow a specific ion to diffuse through a crystal or plastic membrane producing a voltage equivalent to the ion concentration. Electrodes are also used in the environmental analysis of nitrous fumes, sulphur dioxide, ammonia and hydrofluoric acid.

Halogen analysis

Ion selective electrodes have found their greatest application in the analysis of the halogen content of lamps. Sensitivity varies for the different halogens but they can all be measured at less than the 10 microgram level. The electrodes are specific for one halogen and therefore iodine can be distinguished from bromine in a lamp.

The lamp engineers' use of ion selective electrodes has enabled them to dose halogen into a lamp with high precision. This, coupled with a knowledge of the iron level in the filament, has allowed a balance to be obtained between erosion of the lead-in wires in early life caused by excess halogen and early blackening caused by the loss of halogen by combination with iron.

Carbon analysis

The analysis of tungsten filaments for carbon content is an important service provided by the laboratory. Excessive carbon on the surface of the filament encourages the formation of minute cracks which ultimately produce brittle filaments. The carbon content of the bulk filament is normally about 30 to 50 parts per million but the surface layer can contain more than 1000 parts per million if it has been incorrectly processed. The method employed can detect two micrograms of carbon.

The degree of removal of the nitro cellulose binder from the phosphor coating on the inside of the outer bulb of a discharge lamp is also estimated by carbon analysis. If too much carbon remains after the baking process, the phosphor is inefficient and the lamp has a low light-output. Analysis of the phosphor for residual carbon has enabled the lamp engineer to improve the baking process significantly.

Thermal analysis

Valuable information can be obtained by determining the weight changes of materials during heating, decomposition or chemical reaction, for example in the oxidation of a metal.

This process, known as thermal analysis is carried out by the use of a thermogravimetric balance, weighing samples from 1 to 100 milligrammes at temperatures up to 1000°C. Weight changes of one ten millionth of a gramme can be recorded. A differential thermal analyser, capable of attaining 1500°C is used to detect thermal changes such as those which occur during melting and changes in crystal structure in glasses and glass ceramics and to study the rate of decomposition of solid compounds and certain volatile materials.

Electron microscopy and analysis

The most recent addition to the instrumentation in the laboratory is a scanning electron microscope, with an energy dispersive X-ray analyser. This has a usable magnification of 200,000 times and is able to detect all elements heavier than oxygen. The analyser is interfaced to a computer which allows polished flat samples to be quantitatively analysed with a precision of $\pm$ 1% of the major element concentration in only four minutes. The installation is illustrated on page 21 and a typical X-ray spectrum is shown opposite.

The combination of the microscope and the analyser is particularly useful for the qualitative analysis of deposits on bulb walls, crystalline deposits and inclusions. Once the elements present have been identified, quantitative estimates can be made by means of atomic absorption spectrography.

There is also a facility for the mapping of elements, which produces a visual display of the concentration profile of a particular element. The photographs above show a coiled-coil filament in the manufacturing stage at a magnification of 200 times. The centre core and the thicker wire around it are made of molybdenum, but the thinner wire wound around the second molybdenum coil is made of tungsten. The result of analysing for tungsten can be seen in the second photograph, where the bright areas correspond to the position of the tungsten wire.

Technical equipment of this nature is an essential part of the constant search for perfection in the manufacture of electric lamps.

Left: Mr Hargroves is seen noting readings on one of the instruments in the van. The array of instruments at which he is looking is shown in the smaller picture above, while the instrumentation in the cab is shown below.

A mobile road lighting laboratory

R Hargroves and J Green

Mr Hargroves and Mr Green are engaged in Lighting Research at the Jules Thorn Laboratory at Enfield

The effect of installing good modern lighting on a previously unlit or poorly lighted road is to reduce the night-time accident rate by about 30%, on motorways by nearer 40%. By good modern lighting we usually mean that the road surface is bright, there is little glare, and there are no gloomy patches, but the individual effect of each of these factors on accident rates has never been assessed. Questions that need to be answered, for example, are: If road brightness levels are increased, does the number of accidents at night continue to decrease? Is there some upper luminance level over which there is no effect? Would an improved uniformity of lighting reduce casualties more, or would the street lighting engineer be better recommended to concentrate his efforts on reducing glare? When expenditure is limited, the engineer may have to choose between these criteria in designing a lighting installation.

The lack of positive answers to questions such as these prompted the Department of the Environment through the Transport and Road Research Laboratory (TRRL) to initiate a programme of research into the relationship between road lighting and accidents. In 1974, a four year contract for this work was awarded by the DoE to Thorn Lighting. The main objective was the setting up of a mobile laboratory to travel the country to measure the various qualities of the road lighting. The initial part of the project involved making static measurements on a small number of roads, to give further insight into the problems involved. It was realised that a very large number of sites would have to be visited, because there is so much variability between roads, quite apart from their lighting. Making static measurements on such a scale was clearly impracticable.

A van was therefore fitted up as a mobile laboratory and equipment developed and installed in it to enable all measurements to be made dynamically from the moving vehicle. By this means thousands of readings could be recorded in a single night.

The Three Stages of the Operation

It will be seen from the schematic diagram that the information gathered in the mobile laboratory is recorded on video tapes and a data logger. The next stage is to analyse this information, which is carried out in the laboratory at Enfield using specially designed equipment, and finally it is correlated by computer with the accident data supplied by the Local Authorities. It is logical, therefore to consider the equipment in the mobile laboratory and its use and then look at the system of analysis made from the material collected by it.

Closed Circuit TV

The use of a closed circuit television system for this project has a number of advantages over photographic systems, not the least of these being that the tape does not need to be processed before being replayed. This means that the tape can be analysed straight after a site visit. It also means that the tape can be checked on site, and a bad recording retaken without having to arrange a second visit. The television system also lends itself more readily to analysis of the recorded information than photographic systems.

The TV camera views the road through the larger aperture in the front of the roof of the van and a continuous record of the driver's field of view is made on the video tape. The camera's field of view is optically split into two areas, the upper, larger section shows the view of the road ahead of the vehicle, while the smaller contains a grey scale for calibration purposes and a digital display of the distance covered by the vehicle.

Road brightness, or luminance, is the first of the three factors necessary for good street lighting, and it is possible to derive the average luminance of the road surface from the video tapes. The average luminance of other areas such as the pavement or verge is obviously of interest too. In addition the degree of patchiness, or overall uniformity can be assessed by evaluating the range of luminance in the picture.

The Data Logging System

Other lighting quantities are recorded automatically on cassette using a data logger: the degree of disability glare from the road lighting is measured using a photometer mounted behind the windscreen. There is a second mounted behind the smaller aperture in the front of the van roof and this monitors the luminance along the centre of the road, so giving the longitudinal uniformity.

The easiest way to measure the horizontal illuminance of the road surface would be to lay a photocell on it, but since the cell must be mounted on a moving vehicle, the shadows cast

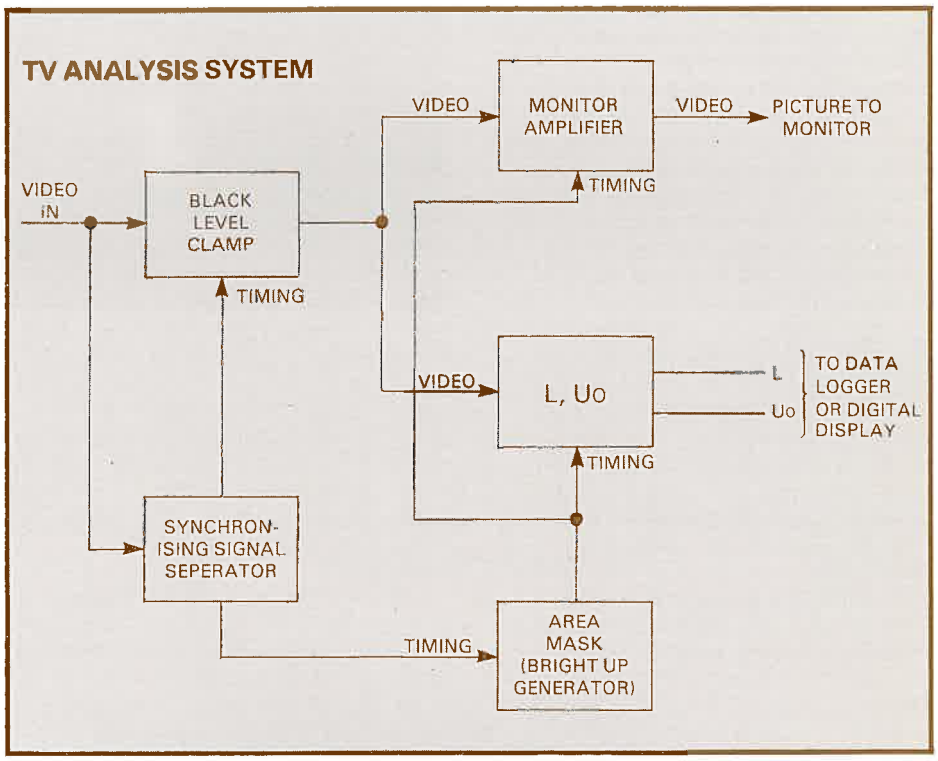
A view of the mobile Laboratory Van. The large square housing for the television camera and the smaller projection housing a photometer can be clearly seen as well as the horn on the roof of the vehicle that screens the photometer pointed at the street lanterns from stray light.

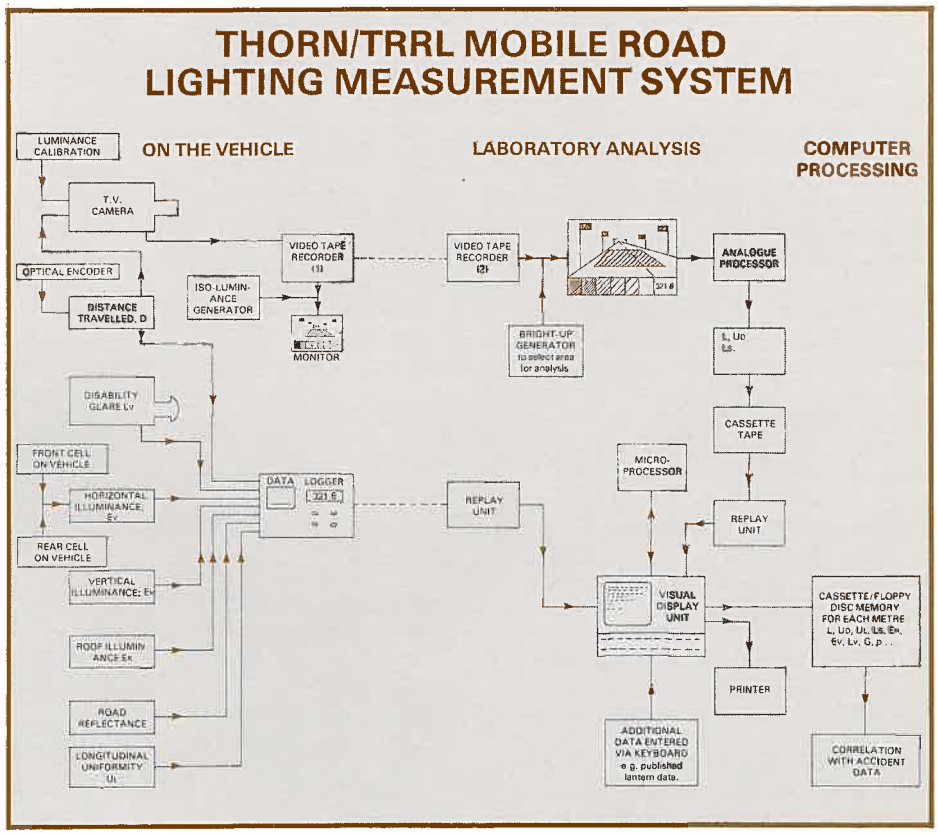
One of the photocell assemblies mounted at the front and rear of the van to measure the incident light when the vehicle is in motion. It is screened to accept light from one hemisphere only.

upon it as the van passes under lanterns poses a difficulty unless it is mounted on a trailer with a tow-line. This is not very convenient, so a system of two additive photocells has been developed. These cells are rigidly mounted horizontally on the front and rear bumpers respectively with shields covering exactly half of each cell so that the front cell "sees" only that light falling in front of the vehicle and the rear cell "sees" only that portion to the rear. The output from the rear cell is added to that from the front one, but with a delay to allow the rear cell to move up to the same position as that originally occupied by the former. Vertically mounted cells in the same assembly record the vertical illuminance in each direction along the road and this can be used to compute the theoretical visibility of objects on the road.

There is also a cell mounted on the roof of the van to monitor the light output from each lantern in turn as the vehicle passes underneath. A horn-shaped shield excludes extraneous lights and can be aimed at any particular line of the lanterns. The illuminance values so obtained from each lantern are then compared with those to be expected if the lanterns were new and a measure is obtained of the depreciation that has occurred. It is then necessary to adjust all the luminance and other results to the average levels pertaining during the 2 - 3 year period over which the accidents happened. The schedules for cleaning and relamping are obtained from the local engineer and must also be considered at this point. Information on lantern mounting height, spacing, lantern and lamp type is also requested from the Local Authority, so that, together with several of the measured quantities, a parameter known as the discomfort glare control mark can be evaluated. This, as its name implies, is an assessment of the visual comfort that the driver feels when travelling through the installation.

The quality of the road surface affects the distribution of the reflected light, and therefore the luminance pattern of the road, considerably. A device to measure the degree of mirror (specular) reflection of the road surface is in the final stages of development. A light is projected under the vehicle and the reflected light picked up by a photocell receiver. The readings from the photocells and photometers are fed to a data logger, and triggered at one metre intervals by a signal, derived from the optical encoder fitted to the vehicle gear-box, which also drives the distance display





for the television recording. This allows information from the logger to be compared with corresponding data from the television analysis.

Laboratory Analysis

The television recording having been made on site, the video tape is then brought back to the Enfield Laboratories for analysis. This can either be done on a frame-by-frame basis, using the still frame facility on the video tape recorder to "freeze" a selected picture, or on a continuous playback mode. The operation of the analysis equipment, however, is the same for both methods and is outlined below.

The television camera generates the television (video) signal by scanning its field of view in a series of near horizontal lines. As the picture is scanned the amplitude of the video signal varies as a function of the luminance of the part of the picture being scanned. The signal also contains synchronising information which indicates the beginning of each horizontal scan line and the end of scanning each complete picture (frame). This synchronising information is extracted in the synchronising separator where it is used to generate fundamental timing signals needed by the rest of the analysis system. The incoming video signal is also processed by a black level clamp circuit, which ensures that a black portion of the picture gives a zero output. It is now necessary for the operator to define the area of the picture to be analysed. This is done by use of the area mask (bright up generator) circuit. This allows the operator to pick an area of variable shape (typically a trapezium) and size anywhere within the picture. The chosen portion of the picture is shown 'brightened up' on a television monitor. The average luminance and standard deviation of luminance within the defined area are thus computed in the final circuit and either displayed on a digital voltmeter or recorded on a magnetic cassette tape using a data logger. The reference step wedge (grey scale) mentioned earlier, which is of known luminance, is used to calibrate the system.

Arranging for Site Visits

As a result of the static measurements made at a dozen road sites early on in the project, it was evident that about 100 sites of any one class would have to be visited if there was to be any chance of a statistically significant relationship with accidents. It was also clear that one class of road could not be compared with another. For example, results from a single carriageway road cannot be compared with those from a dual carriageway, nor those from a 30 MPH limit with results from 40 MPH or derestricted roads. To restrict the number of site visits, it was decided to investigate only two classes of road; 30 MPH and derestricted single carriageway roads. Accident figures are available for a 2-3 year period from the records kept for the relevant roads by the local councils. A correlation could therefore be made between these figures and the lighting data.

County Councils in England, Scotland and Wales were, therefore, asked to recommend roads in those categories which would be suitable for measurement. They were also asked to ensure that the type of lighting installation and the road surface was homogeneous over the length of each site, which itself should be not less than 1 km. On receiving a list of suitable roads, arrangements were made for a week's visit with the Mobile Laboratory and its operating team of three.

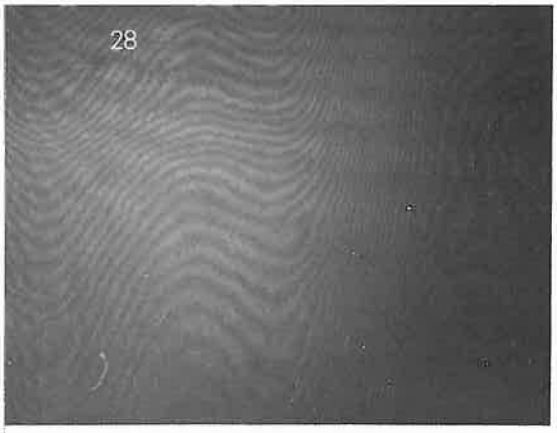
Procedure on Site

On arrival at the town the team contacts the Street Lighting Engineer and a daylight tour of the sites is made. Some sites have to be rejected at this stage because the road surface is too variable. At each acceptable site the start and finish points are carefully noted, a daytime photograph is taken and an assessment of the road surface made: All is then ready for the night visit which cannot commence before 11 p.m., owing to other traffic on the road: the presence of headlights in the television pictures renders them unsuitable for road luminance analysis. At the start of the night's work the aim of the photometers and the camera is checked, calibration levels set, the windscreen cleaned, cassette and video tapes loaded, the distance value set to zero and the roof cell aimed at an overhead lantern.

The run then commences: the operator in the rear sets the distance recorder to "go", the logger to "data record" and the video recorder to "record". The driver keeps the vehicle moving at 15 km/hr, while the third member of the team (in the passenger seat) adjusts the gain of the camera and gives a commentary which is recorded on the audio track of the video recorder. A second run is made in the opposite direction and finally, with the vehicle stationary at a suitable spot, the three operators each make their own personal appraisal of the goodness or otherwise of the lighting: — written down on paper under several headings. The Mobile Laboratory is then driven to the next site and the procedure repeated. Each visit takes about half an hour, and if the sites are grouped close together, as they often are in a provincial town, up to ten can be visited in the one night. Another set of visits is made under different weather conditions so that data for both wet and dry roads can be obtained. The limiting factors to the number of sites visited are the late starting time and the finishing time fixed by dawn. The visit yields several reels of video and cassette tape which can then be taken into the laboratory for analysis.

Information is still being collected and evaluated. If as is hoped some significant relationships are found next year between the different quality values of road lighting and accidents, the conclusions will enable street lighting codes to be overhauled, giving better value for money and better roads for us all.

Mr Green studies the video tape on a television screen in the laboratory. The trapesoidal "brightened up" area can be clearly seen.



The pattern on the original hologram bears no apparent relationship to the image of the lamp which appears when it is viewed under the reference source. The "fringe patterns" indicate convection currents in the gas filling.

Holography and its applications

J R Coaton and I Connor

Dr Coaten and Mr Connor are Discharge Lamp Engineering Manager and Senior Scientist respectively at Thorn's Leicester laboratory.

The science of holography owes its development to the original work of Nobel Prizewinner, Professor Gabor, and to the subsequent research of Leith and Upatnieks at the University of Michigan, following the invention of the gas laser.

Basically, we are only able to see an object because light waves are reflected from its surface; these light waves arrive at our eyes, and as in a camera, they are focussed by a lens to form an image which is subsequently converted to electrical signals and transmitted to the brain. Since we receive simultaneous information with both eyes we are able to see a three dimensional world.

The normal photographic process is deficient because it only records the intensity of the light waves which are focussed onto a film or plate. The final image is built up of light and dark areas, or different shades and colours, but it is essentially a flat two dimensional picture.

In 1948 Gabor proposed a method of overcoming this deficiency by producing a photographic recording of both the intensity and phase of the scattered light from an object, which he called a hologram — literally meaning an entire recording. However to work properly this process required a source of light emitting a single colour only (highly monochromatic) and having all the light waves in phase (coherent); it was only after the development of the gas laser, which meets these stringent requirements, that holography became a practical proposition.

A hologram is made in a photographic dark room where the scene is illuminated by an expanded laser beam. Light scattered from the scene falls on a photographic plate where it mixes with the light from a reference beam, taken directly from the laser, via suitable mirrors and a lens. After developing, the photographic plate shows a completely meaningless pattern formed by the interference of the scattered light and reference beam. In fact, this is a complex coding system containing all the information about the original scene. In a way it is like a stereophonic gramophone record which can only be appreciated when it is played back. The hologram is "played back" by illuminating it with the reference beam alone, and an observer looking through the hologram sees a faithful reconstruction of the scene — in three dimension — exactly as it originally existed. It is not a photograph or projected image, but a full reconstruction of the scene, which even allows the observer to look round corners.

Apart from being a novel art form holography has many scientific and engineering uses. It has been employed for a wide range of applications, including ultra-accurate measuring techniques, and in the lamp industry has been developed as a unique diagnostic tool.

Loughborough University of Technology and Thorn Lighting Limited have had a long association in developing diagnostic techniques for lamps and N J Philips (LUT) and J R Coaton (TLL) have used holography to investigate the density and temperature distribution of the gaseous interior of lamps, and to visualise the flow of gas inside lamp envelopes. Such observations have previously required elaborate experimental techniques, and even so, have been riddled with inaccuracies.

Holography provides a unique method for exploring the interior of a completely standard lamp; this is achieved by superimposing one hologram on top of another (double exposure hologram). First, a hologram is made of an unlit lamp followed by the superimposition of a second hologram, on the same plate, whilst the lamp is running. The reconstruction of this double exposure hologram produces a three dimensional image of the lamp, but in this case showing dark bands, interference patterns within the envelope caused by changes in the temperature, and flow of the lamp gasfilling. These contours give an immediate visualisation of the gas flow, and with suitable interpretation, yield information on the local gas density and temperature. This has provided a much greater insight into the physical mechanisms in lamps than was possible before and the results have been applied to the further development of light sources.

Dans cette édition.

LUMINAIRES EN ATHMOSPHERES EXPLOSIVES OU CORROSIVES 2
R. F. Chatt et M. G. Oakley

Les athmosphères explosives sont un problème constant pour l'industrie, telle que l'industrie pétrochimique et autres, où les appareils d'éclairage sont exposées aux risques d'explosion, à l'humidité et à la corrosion, pour lesquels des mesures spéciales de protcection doivent être prises.

Le Code International de Protection classe les appareils d'éclairage suivant leur degré de protection contre l'humidité, l'entrée de poussière et de corps étrangers et le Code Britannique de Pratique BS 5345 définit les zones pontentiellement dangereuses. Trois zones sont décrites, la zone 0 pour laquelles des gaz ou vapeurs explosives sont continuellement présents, la zone 1 où cette situation peut se développer au cours d'une opération normale, et finalement la zone 2 pour laquelle l'éventualité est peu probable ou ne se produit que pendant une courte période. La classification de la zone correcte est laissée au jugement de l'ingénieur responsable de l'installation.

Aucun appareil électrique n'est permis dans la zone 0, et dans la zone 1 seuls sont permis les appareils anti-déflagrantes pressurisées ou à sécurité renforcée. Ils doivent se conformer aux exigences très sévères des normes BS 229, ES 889 et BS 4533 et, en Grande-Bretagne ils doivent être certifiés "Buxton" par le Service d'Agrément Britannique des Equipements Electriques (BASEEFA). En zone 2, sont permis des appareils à aération réduite ou totalement blindés; egalement homologués par la BASEEFA.

Le nouveau Code de Pratique Britannique BS 5345 comprend une liste complète de gaz et de vapeurs inflammables et donne les températures maxim en surface des appareils. Il est à signaler que certains types de poussières sont également explosifs.

Deux types d'appareils d'éclairage protégés contre la corrosion sont couramment utilisés, le premier type dont le corps de l'appareil, normalement en acier, est protégé par une finition adéquate et l'autre, plus efficace, adopté par Thorn dans la gamme LV des appareils étanches caractérise par une surface extérieure en matière non corrosive.

Il est essentiel de spécifier la substance corrosive, la concentration, la température et l'humidité pour garantir la sélection de la matière correcte du corps.

LA LUMIÈRE ET LA VIE 6
B. Jewess

La lumière, non seulement nous permet de voir ce qui nous entoure, mais les caractéristiques de la plage du spectre électro-magnétique entre 380 et 770 nm affectent la santé et le développement de l'homme, des animaux et des plantes. Bien que le spectre lumineux de certaines sources déclairage artificiel diffère considérablement de celui de la lumière du jour, les radiations aux longueurs d'onde spécifiques affectant les animaux et les plantes sont les mêmes indépendamment de leur source.

L'effet direct des radiations est l'erythème ou "coup de soleil" suivi d'une pigmentation de la peau. Moins connu est l'usage des radiations lumineuses du côté ultraviolet du spectre pour le traitement de la jaunisse néo-natale et de l'hyperbilirubinemia des jeunes enfants, pour lequel des tubes fluorescents bleus et "lumière du nord" ont été substitués à la lumière du jour.

Le traitement du psoriasis, une maladie de la peau défigurante et désagréable, par des traitements aux rayons ultraviolets à grandes ondes après avoir absorbé du psoralen, laisse le patient fortement bronzé et le libère provisoirement des douleurs typiques à cette maladie, mais d'autres irradiations sont nécessaires à intervalles reguliers. Les tubes fluorescentes "lumière du nord" sont courrament utilisés pour ce traitement et les lampes aux iodures métalliques "Graph-X" sont également efficaces.

Le developpement des plantes est affecté par la lumière. Les crêtes d'absorption de la chlorophyle se situent aux extrémités bleu et rouge du spectre, ainsi des lampes émettant des rayons dans ces régions peuvent être utilisées pour l'irradiation des plantes. D'autres utilisations de ces irradiations seront, sans aucun doute, découvertes à la suite de la progression de la science touchant les réactions physiques et chimiques des plantes et des animaux.

ECLAIRAGE DE LA PISTE D'UN HIPPODROME SUÉDOIS 9
Bernth Jansson

La nouvelle piste de l'hippodrome de Malmo est, nous pensons, la seule piste d'Europe éclairée par des lampes CSI disposées sur des mâts de grande hauteur. Trois mâts de 39 mètres dans l'axe de l'hippodrome supportent un total de 209 projecteurs CSI de 1000 Watts et 153 lampes MBIL 1500W sont montées dans des projecteurs Thorn sur les deux plate-formes et en haut d'une mât de 18 mètres entre ceux-ci.

L'installation fournit une moyenne de 445 Lux dans le plan horizontal, 115 dans le plan vertical de la dernière longueur, 220 et 460 Lux sur la piste éloignée, soit un total de 540kW. Les mâts ont été montés en deux stades, les projecteurs CSI étant fixés sur l'ossature au niveau du sol et amenés en position par une grue.

RÉFLEXION SUR L'ÉCLAIRAGE PAR PROJECTEUR 12
D. C. T. Brooks

Au cours des dernières années Thorn a acquis une réputation mondiale dans le domaine de l'éclairage des stades de football et athlétiques mais, bien que de telles installations soient une source efficace de publicité, l'utilisation de projecteur dans l'industrie, le commerce et les centres de loisirs constitue une part beaucoup plus importante et joue un rôle précieux dans l'économie nationale.

Il existe toujours de nombreuses installations en plein air où l'usage d'équipement d'éclairage désuet résulte en un gaspillage considérable d'energie. Les autorités d'éclairage urbain n'ignorent pas les avantages que procure le remplacement des lampes à filaments par des lampes au sodium à basse pression mais, de nombreuses installations industrielles et commerciales sont en retard de modernisation.

Les lois de la Sécurité du Travail saoulignent la nécessité d'un bon éclairage et la norme récente BS 4533 veille à ce que les équipements d'éclairage portant le sigle de sécurité BS soient mécaniquement et électriquement sûrs. Tous les équipements d'éclairage Thorn se conforment aux exigences de cette norme.

L'éclairage urbain peut réduire les crimes et larcins, en particulier s'il soigneusement étudié et les nouvelles sources d'éclairage telles que les lampes SON ont réalisées des économies importantes d'énergie. Ceci est particulièrement sensible dans le cas des lampes SOX recommandées lorsque la couleur émise est sans importance.

Les lampes halogènes au Tungstène sont intensivement utilisées pour les postes de garde et autres applications similaires où un éclairage immédiat est désirable. Elles sont également populaires pour un certain nombre d'applications touchant les loisirs.

TECHNOLOGIE POUR LA FABRICATION D'APPAREILS D'ÉCLAIRAGE 17
L. W. V. Turner

L'usine Thorn Smart et Brown de Rotherwas, près de Hereford, est en activité depuis un certain nombre d'années. Elle a récemment été soumise à une révision complète, le point le plus important étant la réalisation d'une fonderie moderne d'aluminium. Ce bâtiment bien éclairé et aéré est presque deux fois plus grands que son prédécesseur. Il est éclairé par des lampes MBIF aux iodures métalliques montées dans des têtes industrielles "Hi-Pak" qui donnent 500 lux au sol. Les machines d'injection sous pression ont réalisé une économie considérable d'aluminium tout en accélerant le processus de fabrication. Des équipements spécialisés ont été prévus pour l'exécution simultanée de procédés de finition et un service spécialisé dans le moulage de plastiques renforcés à la fibre de verre permet la fabrication d'appareils d'éclairage resistants à la corrosion à un prix de revient considérablement réduit.

L'usine se spécialise également dans l'extrusion de régulateurs et diffuseurs de lumière; ainsi les corps et habillages des équipements d'éclairage urbain, des projecteurs et appareils utilisés en athmosphère corrosive sont fabriqués dans un même atelier, en plus des douilles et ballasts fabriqués dans les autres usines du groupe.

Les conditions de travail très améliorées sont appréciées du personnel et contribuent à de bonnes relations industrielles.

CHIMIE À LEICESTER 21
V. Goddard

Le groupe de chimie du laboratoire de recherche Thorn de Leicester a deux fonctions principales: fournir un service d'analyses aux laboratoires et aux usines et entreprendre des recherches fondamentales. L'identification et la quantification des gaz de remplissage, la détection des impuretés frappant cez gaz et autres composants des lampes, l'analyse des causes des pertes de flux lumineux et des défaillances prématurées sont des sujets entrant dans les activités de ce groupe.

Deux procédés, la spectrographie de masse et la chromatographie liquide, sont utilisés pour l'identification des gaz. Ces deux méthodes sont complementaires, la spectrographie de masse étant utilisée pour détecter les impuretés et la chromatographie liquide pour mesurer, d'une manière très précise, les composants principaux. Par exemple, ces méthodes sont utilisées pour mesurer la quantité d'eau et d'oxygène des composés iodures métalliques avant de les doser dans les lampes, ce qui réduit le risque d'érosion des électrodes.

La spectrographie d'absorption atomique est utilisée dans des buts tels que la mesure de la teneur en fer des filaments en tungstène des lampes halogènes de ce type. Une teneur trop forte en fer résulte en une diminution de l'halogène de la lampe en cours de service. Cette méthode permet la vérification du niveau des impuretés de la poudre d'alumine utilisée à la fabrication des tubes à arc des lampes au sodium à haute pression et la mesure de la transmission en rayons ultraviolets des tubes au quartz des lampes à arc au mercure. Un four au carbone permet la détection des quantités infimes.

L'étude des polluants athmosphériques et autres peut être effectuée à l'aide d'électrodes sélectives à ions. Ces électrodes sont utilisées pour l'analyse d'athmosphères contenant des vapeurs nocives diverses et l'analyse de la teneur en hydrogène des lampes halogènes au tungsten.

D'autres procédés, tels que l'analyse thermique et la cartographie des éléments par rayons X sont également utilisés, en particulier pour l'identification d'éléments déposés sur la paroi de l'ampoule, de dépôts cristallins et d'inclusions. La technologie analytique moderne est à même d'aider la résolution de problèmes affectant les lampes et parfois résulte en l'elaboration de sources d'éclairage améliorées.

LABORATOIRE MOBILE D'ÉCLAIRAGE URBAIN 25
R. Hargroves et J. Green

Un bon éclairage doit donner une lumière brillante sur la surface des routes sans éblouissement et sans zones laissées dans la pénombre, mais les effets individuels de ces facteurs sur le taux des accidents nont jamais été évalués et ceci a incité le Ministère de l'Environnement, par l'intermédiaire du laboratoire de Recherche de la Circulation et du Transport, à lancer un programme de recherche pour lequel le contrat a été accordé à Thorn Lighting en 1974.

Un fourgonette a été équipée en laboratoire et grâce à ceci, des milliers de relevés peuvent être effectués et enregistrés chaque nuit sur bandes vidéo et enregistreurs automatiques. Grâce à l'utilisation d'un système de télévision en circuit fermé, les résultats peuvent être vérifiés immédiatement, dès le retour et les enregistrements mis à jour si nécessaire. L'équipement de la fourgonette et en particulier la position des instruments d'enregistrement tels que cellules photo-électriques demandent une ingéniosité considérable.

Les bandes vidéo sont analysées par le Laboratoire Thorn d'Enfield au moyen d'appareils spécialement prévus à cet effet et de l'ordinateur du laboratoire.

Les routes en observation étaient confinées aux routes à deux sens de circulation dont la vitesse est limitée à 45 kmh et aux routes frappées de la limitation normale de vitesse. 100 échantillons de ces deux types de route par temps sec et pluvieux ont été nécessaires pour obtenir des statistiques valables. Ces observations ont été faites dans un certain nombre de villes, et après un reconnaissance au cours de la journée, la fourgonette et son équipage circulent la nuit à partir de 23 heures jusqu'à l'aube sur les itinéraires agrées. Nous espérons, après avoir terminé cette analyse, que les résultats donneront une source de renseignements précieux pour l'étude efficace des installations d'éclairage des routes.

L'HOLOGRAPHIE ET SES APPLICATIONS 28
J. R. Coaton et I. Conner

La science de l'holographie a été développée par le Professeur Gabor, les recherches ultérieures ont été effectuées par Leith et Upatneks, après l'invention du laser à gaz.

Par une méthode photographique normale, seule une image à deux dimensions peut être reproduit; un hologramme produit une image à trois dimensions pouvant être explorée en profondeur. Cet hologramme est réalisé dans une chambre noire photographique dans laquelle la scène ou l'objet à reproduire est illuminé par un rayon laser alors que la lumière venant de la même source est dirigée sur une plaque sensible. Le résultat est une image apparemment sans aucun sens formée par l'interférence de la lumière réflechie de l'objet et le rayon de référence. L'hologramme est alors rendu intelligible en l'illuminant seulement avec le rayon de référence, ce qui a pour effet de donner une image à trois dimensions exactement comme l'original; l'observateur peut même regarder derrière les coins.

L'holographie est utilisée pour examiner les courants gazeux des lampes à filament en observant les modèles d'interférence causés par une double exposition. Cette méthode permet une précision beaucoup plus grande de celle obtenue auparavant par l'utilisation d'enveloppes en verre spécialement fabriquées.

In dieser Ausgabe.

LEUCHTEN IN EXPLOSIONSGEFÄHRDETEN BZW: KORROSIVEN ATMOSPHÄREN 2
von R.F. Chatt und M.G. Oakley

In gewissen Industrien wie der Petrochemie bilden explosionsgefährdete Atmosphären ein ständiges Problem. Das gleiche gilt auch für andere Situationen, in denen Leuchten der Gafahr von Explosionen oder feuchten bzw. korrosiven Atmosphären ausgesetzt sind, und in allen derartigen Fällen müssen spezielle Schutzmaßnahmen ergriffen werden.

Der "International Protection Code" (Schutzart) stuft Leuchten danach ein, in welchem Maße sie gegen Feuchtigkeit und das Eindringen von Staub bzw. kleinen Fremdkörpern geschützt sind, während der British Code of Practice BS 5345 potentiell gefährliche Bereiche einstuft. Diese sind in drei Zonen unterteilt: Zone O, in der ständig explosive Gase oder Dämpfe vorhanden sind; Zone 1, wo die Wahrscheinlichkeit besteht, daß derartige Gase oder Dämpfe bei normalem Betrieb auftreten; und Zone 2, wo diese Wahrscheinlichkeit nicht besteht oder wo mit ihnen nur kurzzeitig zu rechnen ist. Um welche Zone es sich handelt, hat der für die Anlage verantworliche Ingenieur zu entscheiden.

In Zone O sind keine elektrischen Geräte zulässig, und in Zone 1 nur als "explosionsgeschützt" bescheinigte druckfeste bzw. hochsichere Leuchten. Diese müssen den sehr strengen Vorschriften der britischen Normen BS 229 und BS 889 sowie BS 4533 entsprechen und sind im Vereinigten Königreich nur mit der "Buxton-Bescheinigung" des British Approvals Service for Electrical Equipment (BASEEFA) zulässig. In Bereichen der Zone 2 dürfen nur vollkommen gekapselte Leuchten bzw. Leuchten mit ganz oder teilweise gehemmtem Luftdurchgang verwendet werden, und auch diese erfordern die BASEEFA-Bescheinigung.

Der neue British Code of Practice BS 5345 enthält eine umfassende Liste entzündlicher Gase und Dämpfe und gibt die maximal zulässigen Oberflächentemperaturen von Leuchten an. Man bedenke auch, daß gewisse Staubarten explosionsgefährlich sind.

In der Regel werden zwei Arten korrosions geschützter Leuchten gefertigt-eine, bei der das herkömmliche Stahlgehäuse der Leuchte einer Schutzbehandlung unterzogen wird, und eine mehr zufriedenstellende Leuchte, bei der alle Teile des Außengehäuses aus korrosionsbeständigem Werkstoff bestehen. Die LU-Reihe der von Thorn gefertigten Leuchten besitzt Außengehäuse dieser Art.

Um sicherzustellen, daß die Werkstoffe und die Gehäuseart der Anwendung entsprechen, müssen der korrosive Stoff, seine Konzentration, die vorherrschende Temperatur und die Luftfeuchtigkeit angegeben werden.

LICHT FÜR LEBEWESE 6
von B. Jewess

Licht ermöglicht es uns nicht nur zu sehen, sondern wirkt durch die Eigenschaften der zwischen 380 und 770 nm gelegenen Teiles des elektromagnetischen Spektrums auch auf die Gesundheit und das Wachstum der Menschen, Tiere und Pflanzen ein. Die Spektra gewisser Quellen künstlichen Lichtes unterscheiden sich von denen natürlichen Tageslichtes erheblich, doch sind stets Strahlungen der gleichen Wellenlängen für Tiere und Pflanzen von Bedeutung, ohne Rücksicht auf ihren Ursprung.

Erythem oder Sonnenbrand und die dadurch bedingte Färbung der Haut sind Beispiele unmittelbarer Einwirkung des Lichts. Weniger bekannt ist die Anwendung von Licht am blauen Ende des Spektrums zur Behandlung von Gelbsucht oder einem Überschuß an Bilirubin im Blut bei Kleinkindern. Bei dieser Behandlung wurde Tageslicht mit Erfolg durch Blaulicht- und "Northlight" -Leuchtstoffröhren ersetzt.

Die Behandlung von Schuppenflechte, einer unangenehmen und häßlichten Hautkrankheit, durch Ultraviolett-Langwellenbestrahlung nach Einnahme des Arzneimittels Psoralen hat zur Folge, daß der Patient stark gebräunt wird und vorübergehend von den für die Krenkheit kennzeichnenden schmerzhaften Flecken infizierter Haut frei ist, doch ist weitere Bestrahlung in regelmäßigen Zeitabständen unerläßlich. "Northlight" -Leuchtstoffröhren werden allgemein für diese Behandlung benutzt, und auch die Graph-X Metall-Halogenlampe hat sich in diesem Zusammenhang als nützlich erwiesen.

Licht übt auf das Wachstum von Pflanzen einen Einfluß aus. Chlorophylabsorption ist an dem blauen und an dem roten Ende des Spektrums am intensivsten, so daß Lampen, die den größten Teil ihrer Energie in diesen Bereichen abgaben, zur Bestrahlung von Pflanzen geeignet sind. Ohne Zweifel werden noch andere Anwendungen der Bestrahlung entdeckt werden, indem unsere Kenntnisse der physikalischen und chemischen Reaktionen von Pflanzen und Tieren zunehmen.

BELEUCHTUNG DER SCHWEDISCHEN TRABRENNBAHN 9
von Bernth Jansson

Die neue Trabrennbahn in Malmö ist wohl die einzige europäische Rennbahn dieser Art, die durch auf hohen Masten angeordnete CSI-Lampen beleuchtet wird. Drei 39 m hohe Maste entlang der Mittellinie der Bahn tragen insgesamt 209 1000W CSI-Flutlichtleuchten, und weitere 153 lineare Metall-Halogenlampen sind in Thorn Flutleuchten über den beiden Tribünen und auf einem dazwischen befindlichen 18 m hohen Mast angeordnet.

Die Anlage liefert entlang der Zielgeraden im Durchschnitt 445 lx horizontale und 115 lx vertikale Beleujchtungsstärke Entlang der restlichen Strecke beträgt die Beleuchtungsstärke 220 bzw. 460 lx. Die Leistungsaufnahme beläuft sich auf 540 kW. Die Maste wurden in zwei Stufen errichtet. Zuerst wurden die CSI-Leuchten am Boden an die Leuchtenrahmen montiert, worauf diese mit Hilfe eines Krans angehoben wurden.

EINIGE GEDANKEN ZU DEM THEMA DER FLUTLICHTBELEUCHTUNG 12
von D. C. T. Brooks

In den letzten Jahren hat Thron als spezialisierter Lieferant von Beleuchtungsanlagen für Fußballplätze und Stadien Weltruf gewonnen, doch obgleich derartige Anlagen den Namen des Konzerns in den Vordergrund rücken, ist diese Beleuchtung in der Industrie, im Handel und in der Freizeitgestaltung vom Standpunkt des Konzerns noch wichtiger. Diese Anlagen spielen in der Wirtschaft des Landes eine bedeutende Rolle.

Es gibt auch heute noch zahlreiche Freiluftanlagen, bei denen veraltete Leuchten zu erheblicher Stromverschwendung führen. Die für die Straßenbeleuchtung verantwortlichen Behörden sind sich der Vorteile bewußt, die der Übergang von altmodischen Glühlampen auf Natriumniederdrucklampen bedingt, doch zahlreiche Industrie- und Handelsorganisationen sind in dieser Hinsicht noch recht rückständig.

Das neue britische Gesetz über Sicherheit am Arbeitsplatz betont die Notwendigkeit guter Beleuchtung in derartigen Bereichen, und die neue Norm BS 4533 gewährleistet, daß mit dem BS-Sicherheitszeichen versehene Leuchten in mechanischer und elektrischer Hinsicht sicher sind. Alle von Thorn im Zusammenhang mit Flutlichtbeleuchtung gelieferten Vorrichtungen entsprechen diesen Erfordernissen.

Beleuchtung im Freien kann besonders bei sorgfältiger Planung Verbrechen im großen und kleinen Maßstabe einschränken, und bei Gebrauch der neuen Lichtquellen wie der SON-Lampe läßt sich der Stromverbrauch erheblich senken. Besonders viel Strom wird bei Anwendung der SOX-Lampen eingespart, die für Anwendungen empfohlen werden, in denen Farbtreue unwesentlich ist.

An Fabriksporten und ähnlichen Punkten, wo unverzüglich eine große Lichtmenge eforderlich sein kann, wird viel Gebrauch von Halogenglühlampen gemacht; diese sind auch mit Recht im Zusammenhang mikt verschiedenen Formen der Freizeitgestaltung beliebt.

VERFAHREN DER LEUCHTENFERTIGUNG 17
von L.W.V. Turner

Das Werk der Firma Thorn Smart & Brown in Rotherwas bei Hereford steht seit einigen Jahren in Betrieb. Vor kurzem wurde es vollständig überholt und umfaß nun eine moderne Aluminiumgießerei. Dieses helle, luftige Gebäude ist nahezu doppelt so groß wie die alte Gießerei war und wird mit MBIF-Lampen in Hi-Pak-Leuchten beleuchtet. Die Beleuchtungsstärke beträgt 500 lx. Spritzgußmaschinen haben die Wirtschftlichkeit dar Aluminiumgießerei sehr erhöht und das Fertigungsverfahren bescheunigt. Es wurden Spezialgeräte entwickelt, so daß nun eine Reihe von Fertigungsverfahren gleichzeitig ausgeführt werden kann. Eine Abteilung dient dem Pressen von glasfaserverstärkten Kunststoffen. Sie hat erhebliche Senkungen der Fertigungskosten bewirkt und stellt korrosionsbeständige Leuchten mit sehr wirtschaftlicher Geschwindigkeit her.

Das Werk stellt auch stranggepreßte Lichtleit- und Streuelemente aus Kinststoff her, so daß nun alle Gehäuseteile von für Straßenbeleuchtung, Flutlichtbeleuchtung und den Einsatz in korrosiven Atmosphären beabsichtigte Thorn-Leuchten in einem einzigten Werk gefertig werden. Nur die in anderen werken des Konzerns gefertigten Lampenfassungen und Schaltvorrichtungen müssen noch hinzugefügt werden.

Die sehr verbesserten Betriebsbedingungen haben bei dem Personal großen Anklang gefunden und tragen zu den guten Beziehungen zwischen den Angestellten und der Betriebsleitung bei.

CHEMIE IN LEICESTER 21
von V. Goddard

Die Chemieabteilung der in Leicester befindlichen Forschungslaboratorien des Thorn-Konzerns hat zwei Funktionen. Sie führt im Auftrag der Betriebslaboratorien und Werke des Konzerns Analysen aus und leistet grundlegende Forschung. Zu den Tätigkeiten der Abteilung zählen die Bestimmung und mengenmäßige Erfassung von Füllgasen, das Feststellen von in den Gasen und in Bestandteilen der Lampen enthaltenen Verunreinigungen und die Analyse der zu verringerter Lichtausbeute oder vorzeitigem Ausfall führenden Ursachen.

Bei der Bestimmung von Gasen finden zwei Verfahren — Massenspektrographie und Gas-Flüssig-Chromatographie — Anwendung. Sie ergänzen einander, und zwar wird von der Massenspektrographie zur Feststellung von Verunreinigungen und von der Gas-Flüsig-Chromatographie zur genauen Messung der Hauptbestandteile Gebrauch gemacht. So werden zum Beispiel die Wasser- und Sauerstoffmengen in Metall-Halogenverbindungen gemessen, bevor sie in die enizelnen Lampen eingeführt werden, um die Gefahr der Elektrodenerosion auf ein Mindestmaß einzuschränken.

Der Eisengehalt in den aus Wolfram bestehenden Glüfäden von Halogenlühlampen wird durch atomare Absorptionsspektrographie gemessen, und das gleiche Verfahren findet auch bein anderen Aufgaben Anwendung. Falls der Glüfaden zuviel Eisen enthält, findet während der Lebensdauer der Lampe eine Halogenabnahme statt. Nach dem gleichen Verfahren werden die Verunreinigungsgrade der bei der Fertigung von Bogenröhren für Natriumhochdrucklampen angewandten Aluminiumoxydpulver bestimmt, und es ermöglicht auch die Messung der UV-Derchlässigkeit der zu Quecksilverbogenlampen verarbeiteten Quarzglasröhren. Ein Kohlenstoffofen ermöglicht die Bestimmung sehr kleiner Mengen.

Mit Hilfe von ionenselektiven Elektroden können Luft- und andere Schmutzstoffe erforscht werden. Derartige Elektroden finden bei der umwelttechnischen Analyse verschiedener schädlicher Dämpfe sowie der Bestimmung des Wasserstoffgehalts von Halogenglühlampen Anwendung.

Thermische Analyse und Röntgenkartierung von Elementen sind andere Verfahren, von denen Gebrauch gemacht wird, insbesondere bei der Bestimmung von an Lampenwänden abgeschiedenen Elementen, kristallinen Ablagerungen und Einschlüssen. Moderne analytische Verfahren können die Lösung von Lampenproblemen erleichtern und führen manchmal zur Entwicklung verbesserter Lichtquellen.

EIN FAHRBARES STRAßENBELEUCHTUNGSLABOR 25
von R. Hargroves und J. Green

Gute Straßenbeleuchtung sollte eine helle und gleichzeitig möglichst blendfreie Straßenorberfläche ohne dunkle Bereiche ergeben, doch die Bedeutung jedes dieser Faktoren vom Standpunkt der Unfellshäufigkeit war niemals erforscht worden. Aus diesem Grunde beschloß das britische Ministerium für Umwaltgestaltung durch das Transport and Road Research Laboratory ein Forschungsprogramm in die Wege zu leiten, und 1974 wurde Thorn Lighting mit der Durchführung dieses Vorhabens beauftragt.

Es wurde ein Wagen als fahrbares Labor eingerichtet. Dieses ermöglichte es, in einer einzigen Nacht tausende Messungen vorzunehmen und die Meßwerte auf Videoband und mit Hilfe eines Datenerfassungsgeräts festzuhalten. Kabelfernsehen gestattete die Überprüfung der erfaßten Werte unmittelbar nach dem Besuch eines bestimmten Bereichs, und falls erforderlich konnten neue Messungen vorgenommen werden. Die Ausrüstung des Wagens und insbesondere die Anordnung der Meßvorrichtungen wie zum Beispiel Fotozellen erforderten erhebliches technisches Können.

Die Videobänder werden in dem in Enfield befindlichen Thorn-Labor analysiert, wobei von einer Reihe von Spezialgeräten sowie dem Laborrechner Gebrauch gemacht wird.

Es wurden nur Straßen mit einer Fabrbahn und einer Geschwindigkeitsgrenze von 30 Meilen/h sowie Straßen ohne Geschwindigkeitsgrenze bearbeitet, und es waren rund 100 Proben von Straßen jeder Art bei nassem und trockenem Wetter erforderlich, um annehmbare statistische Unterlagen zu erzielen. Es wurden mehrere Städte besucht, und nach Besichtigung der betreffenden Straßen bei Tage verbrachte das Team die Nacht von rund 23.00 Uhr bis zum Sonnenaufgang damit, die ausgewählten Strecken abzufahren. Diese Analyse sollte wertvolle Daten für bessere Planung von Straßenbeleuchtungsanlagen liefern.

DIE HOLOGRAPHIE UND IHRE ANWENDUNGEN 28
von J.R. Coaton und I. Conner

Die Wissenschaft der Holographie wurde von Professor Gabor entwickelt, und weitere Forschung auf diesem Sektor wurde nach Erfindung des Gaslasers von Leith und Upatneks durchgeführt.

In einer normalen Fotografie entsteht nur ein zweidimensionales Bild. Ein Hologramm degagen liefert ein dreidimensionales Bild, das der Tiefe nach erschlossen werden kann. Es wird in einer fotografischen Dunkelkammer angefertigt, wo das Aufnahmeobjekt durch ein kohärentes Lichtbündel beleuchtet wird, während Licht von der gleichen Quelle auf die lichtempfindliche Platte gerichtet wird. Das Ergebnis ist ein anscheinend regelloses Muster, das durch die Interferenzfigur des von dem Objekt reflektierten Lichts und des Referenzbündels gebildet wird. Das Hologram wird "abgespielt", indem man es mit dem Referenzbündel allein beleuchtet, worauf es ein genaues dreidimensionales Bild des aufgenommenen Objekts bietet. Der Betrachter kann sogar um Ecken herumblicken.

Die Holographie wird zur Untersuchung von Gasströmen in Glühlampen angewandt, und zwar werden die bei Doppelbelichtung entstehenden Interferenzfiguren untersucht. Dieses Verfahren ermöglicht es, eine viel höhere Genauigkeit zu erzielen als bei Anwendung speziell gefertigter Glashüllen.

En esta edición.

LUMINARIAS EN AMBIENTES EXPLOSIVOS O CORROSIVOS 2
R. F. Chatt y M. G. Oakley

ALUMBRADO DE LA PISTA DE CARRERAS DE CABALLOS TROTONES DE MALMOE SUECIA 9
Bernth Jansson

LUZ PARA TODO LO VIVIENTE 6
B. Jewess

ALGUNAS IDEAS SOBRE EL ALUMBRADO POR PROYECTORES 12
D.C.T. Brooks

TÉCNICAS INHERENTES A LA FABRICACIÓN DE LUMINARIAS 17
L.W.V. Turner

ACTIVIDADES QUÍMICAS EN LEICESTER 21
V. Goddard

LABORATORIO AMBULANTE DE ALUMBRADO DE CARRETERAS 25
R. Hargroves y J. Green

HOLOGRAFÍA Y SUS APLICACIONES 28
J.R. Coaton e I. Conner

La existencia de atmósferas explosivas constituyen un problema perpetuo en industrias tales como la petroquímica, y en otras condiciones en las que las luminarias se hallan expuestas al riesgo de explosión o a atmósferas húmedas o corrosivas, han de adoptarse especiales medidas de protección.

El Código Internacional de Protección clasifica las luminarias de acuerdo con su protección contra la humedad y contra la penetración de polvo o de diminutos cuerpos extraños, y el Código Británico de Prática, BS 5345, clasifica las zonas potencialmente peligrosas. Se describen tres zonas, a saber: Zona O en la que es continua la presencia de gases o vapores explosivos; Zona 1 en la que es probable que tenga lugar tal presencia; y Zona 2 en la que no es probable que se produzca tal presencia o, en caso positivo, sólo por breves momentos. Queda de responsabilidad del ingeniero encargarse de decidir la clasificación correcta de la zona.

En la Zona O queda terminantemente prohibida la utilización de aparatos eléctricos, mientras que en la Zona 1 sólo se permiten luminarias antideflagrantes presionizadas o de seguridad incrementada certificada. Estas luminarias han de cumplir con los requisitos muy rigurosos de las normas BS 229, BS 889 y BS 4533 del Reino Unido y gozar del Certificado Buxton expedido por el Servicio Británico de Aprobaciones para Equipos Eléctricos (BASEEFA). En sectores de la Zona 2 sólo se permite el empleo de luminarias de "respiración restringida" o totalmente encerradas, las cuales han de gozar también del correspondiente certificado de BASEEFA.

El nuevo Código Británico de Práctica, BS 5345, incluye una relación muy completa de gases y vapores inflamables y una lista de las temperaturas máximas de superficie permisibles para las luminarias. No debe olvidarse la caractéristica explosiva inherente también a ciertos tipos de polvo.

Por regla general, las luminarias a prueba de corrosión se encuadran en dos tipos, uno en el que se aplica un acabado protector al cuerpo normal de acero de la luminaria, y el segundo y más satisfactorio, el adoptado por Thorn en la gama LU de luminarias, en el que toda la superficie exterior de la luminaria se fabrica utilizando un material que goza de propiedades anticorrosivas.

Para cerciorarse de que se emplea el material y cubierta idóneos, es preciso hacer constar la substancia corrosiva, así como la concentración, temperatura y humedad de la misma.

B. Jewess

La luz no sólo nos sirve para ver; las características espectrales de aquellos sectores del espectro electromagnético entre 380 y 770 n.m., ejercen su influencia en la salud y en el desarrollo de los hombres, de los animales y de las plantas. Los espectros de algunas fuentes de luz difieren notablemente de los de la luz natural del día, aunque la radiación en longitudes de onda específicas que afecta a animales y plantas es la misma cualquiera que sea su fuente u origen.

A título de ejemplo de efectos de acción directa, podemos citar el eritema o quemadura del sol y la consiguiente pigmentación de la piel. Resulta menos conocida la utilización de la luz en el extremo azul del espectro para el tratamiento de la ictericia neonatal, o hiperbilirubinemia, de infantes, para el que como sustitutos de la luz natural se han utilizado con todo éxito tubos fluorescentes azules y de "luz-norte."

La psoriasis, enfermedad de la piel que resulta incómoda y desagradable a la vista, cuando se trata con rayos ultravioleta de onda larga después de la ingestión de la droga "Psoralen", deja al paciente muy "tostado" y temporalmente libre de manchas dolorosas de piel infectada, típicas de esta enfermedad, si bien se precisa aplicar más tratamiento de radiación a intervalos regulares. Es corriente el empleo de tubos fluorescentes tipo "luz-norte" para este tratamiento y ha dejado muestra patente de su utilidad la lámpara mercurio-haloide "Graph-X".

La luz afecta al crecimiento de las plantas. Los picos del espectro de absorción de clorofila en los extremos azul y rojo del espectro hacen que las lámparas que emiten la major parte de su energía en estos sectores, pueden emplearse para la radiación de las plantas. Sin duda, se desarrollarán otras aplicaciones de la radiación, a medida que aumentan los conocimientos de las reacciones físicas y químicas de las plantas y de los animales.

Bernth Jansson

Se cree que la pista de carreras de caballos trotones de Malmoe es la única de Europa que se halla iluminada por focos CSI instalados sobre altas torres. Se trata de una instalación de tres torres de 39 m. de altura a lo largo de la línea central del hipódromo que cuentan con un total de 209 focos CSI de 1000W y 153 focos de mercurio-haloide lineal adicionales montados en proyectores de alta intensidad de Thorn sobre las dos tribunas y sobre una torre más de 18 m. que se halla entre ellas.

Todo esta instalación proporciona un promedio de 445 lux en plano horizontal y 115 en el vertical en la recta final de la pista, y 220 y 460 lux en el tramo del extremo, cuya capacidad total asciende a 540 kW. Las torres se instalaron en dos fases, la primera correspondió a la fijación de los focos CSI a los armazones de la parte alta de las torres, operación realizada a nivel del suelo, y la segunda que consistió en el izado con grúa de dichas torres hasta situarlas en su posición definitiva.

D.C.T. Brooks

En el curso de los últimos años, Thorn ha ido acumulando gran prestigio internacional en su calidad de especialistas en el alumbrado de campos de fútbol y estadios, si bien a pesar de la publicidad que tales instalaciones aportan, el empleo de iluminación por proyectores en la industria y en los sectores comercial y de espectáculos, etc., desempena un papel aún más importante entre las actividades de la Compañia y constituye una aportación valiosa para la economía nacional.

Existen aún hoy día un gran número de instalaciones al aire libre cuyo equipo de alumbrado es anticuado y da lugar a desperdiciar la energía. Las autoridades a cuyo cargo se halla el alumbrado de las calles, son conscientes de la ventaja que reporta el cambiar del alumbrado en desuso a base de bombillas de filamento, al basado en sodio a baja presión, pero muchas instalaciones a nivel industrial y comercial continúan quedándose atrás.

Los mandatos que ampara "la Ley de Seguridad en el Trabajo" han subrayado la necisidad de contar con buen alumbrado en tales situaciones, y la nueva norma BS 4533 asegura que el equipo de alumbrado portador de la Marca de Seguridad BS goce de seguridad tanto mecánica como eléctrica.

El buen alumbrado al aire libre contribuye a la reducción de delitos y despilfarros, en especial cuando se proyecta con minuciosidad, y las fuentes nuevas de luz tales como la lámpara SON han contribuido en gran modo a notables economías en el consumo de energía. Esto ha podido observarse sobremanera en el caso de las lámparas SOX que son objeto de recomendación en aquellos casos en que no es vital la fidelidad del color.

Las lámparas de cuarzo-iodo se utilizan ampliamente en zonas de entrada y puntos similares en los que se requiere una profusión inmediata de luz; estas lámparas son merecidamente de uso generalizado en cierto número de centros de recreo y espectáculo.

L.W.V. Turner

La fábrica de Thorn, Smart & Brown, sita en Rotherwas, cerca de Hereford, ha estado funcionando durante muchos años. Recientemente ha sido objeto de una revisión general que ha culminado con la finalización e inauguración de una moderna fundición de aluminio. Este nuevo complejo que goza de buen alumbrado y magnífica ventilación, es casi dos veces major que el antiguo y se halla iluminado por lámparas MBIF en luminarias "Hi-Pak" de 500 lux. Las unidades de fundición a troquel han logrado una economía considerable en el empleo de aluminio así como en el tiempo dedicado a los procesos de fabricación. Se ha concebido equipo especializado que permite llevar a cabo simultáneamente los procesos de acabado y el complejo cuenta con un departamento dedicado al moldeo de plásticos reforzados con fibra de vidrio, reduciendo los costos de producción y fabricando luminarias a prueba de corrosión a un ritmo que resulta de gran economía.

En esta fábrica se extruyen también pantallas y difusores de material plástico, así como los cuerpos destinados a las luminarias Thorn para alumbrado de calles, para alumbrado de gran intensidad con proyectores y para utilización en ambientes corrosivos. Los portalámparas y los dispositivos de control se fabrican en otras fábricas pertenecientes a la Compañía.

La gran mejora experimentada en las condiciones de trabajo merece la justa apreciación por parte del personal y contribuye al mantenimiento de excelentes relaciones laborales.

V. Goddard

El grupo dedicado a actividades químicas en los laboratorios de investigación con que cuenta la Compañía en Leicester, ha de desempeñar dos funciones principales, a saber: la de proporcionar facilidades analíticas de asistencia a laboratorios y fábricas y la de llevar a cabo los trabajos básicos de investigación. Pueden encuadrarse entre las actividades de este grupo las de identificar y cuantificar los gases de carga, la detección de impurezas en éstos y en otros componentes de las lámparas y el análisis de las causas que motivan la pérdida de intensidad de luz o el fallo prematuro de las instalaciones.

Para la identificación de los gases se emplean dos técnicas: la de espectrografía y la cromatografía de gas líquido. Estas dos técnicas se complementan entre sí, mientras que la espectrografía de masa de destina a la detección de impurezas y la cromatografía de gas líquido sirve para medir los constituyentes principales con gran precisión.

La espectrografía por absorción atómica se emplea para fines tales como la medición del contenido de hierro en el filamente de tungsteno de una lámpara de tungsteno-halógeno. Una cantidad excesiva de hierro dará lugar a una disminución del halógeno de la lámpara durante su servicio. También se emplea para verificar los niveles de impureza del polvo de alumina utilizado para la fabricación del tubo de arco de lámparas de sodio de alta presión, y evalúa la transmisión UV de los tubos de cuarzo fundido empleados en lámperas de arco de mercurio. Un horno de carbón permite la detección de cantidades minusculas de hierro.

El estudio de contaminantes atmosféricos y de otros tipos, puede llevarse a cabo utilizando electrodos ioniselectivos. Estos se emplean en el análisis del medio ambiente de varias emanaciones nocivas, así como en el análisis del contenido de hidrógeno de las lámparas tungsteno-halogenos.

Igualmente, se ponen en práctica otros métodos tales como el análisis térmico y la configuración de elementos por Rayos X, especialmente de aquellos elementos que se depositan sobre las paredes de las bombillas, de sedimentos cristalinos y de inclusiones. Las modernas técnicas analíticas pueden contribuir a la solución de problemas presentados por las lámparas y, en ocasiones, son conducentes a la producción de fuentes de luz más perfeccionadas.

R. Hargroves y J. Green

Un alumbrado adecuado para las calles debe proveer una superficie clara del pavimento, debe originar un deslumbramiento mínimo y no debería dar lugar a sectores obscuros, aunque no se haya evaluado aún el efecto individual de estos factores sobre los índices de accidentes, y esto ha motivado que el Departamente del Medio Ambiente, a través del Laboratorio de Investigación de Transportes y Carreteras, haya inicado un programa de investigación cuyo contrato fue adjudicado a Thorn Lighting en el año 1974.

Se preparó una furgoneta como laboratorio ambulante por medio del cual se obtuvieron miles de lecturas en una sola noche que fueron registradas en cintas de video y en un clasificador de datos. Mediante un circuito cerrado de televisión, podían comprobarse inmediatamente los resultados después de realizar la visita oportuna al sitio y, de ser necesario, se realizarían las entradas de nuevos asientos. Tanto el equipo instalado en la furgoneta como el emplazamiento en particular de los instrumentos de registro exigieron notable grado de perfeccionamiento.

Las cintas de video fueron objeto de análisis en el laboratorio de Thorn ubicado en Enfield, tarea para la que hubo de dedicarse un cierto número de unidades de aparatos de diseno especial, además del calculador electrónico con que cuenta dicho laboratorio.

Las carreteras que fueron objeto de investigación se limitaron a las de un sólo carril con límite de velocidad de 50 kms/h. y carreteras sin tal límite de velocidad, extrayéndose unas cien muestras de cada tipo en condiciones húmedas y secas, que fueron las necesarias para lograr una muestra estadística de valía razonable. Se realizan visitas de sitios de cierto número de poblaciones y, después de la presencia durante el día en las carreteras que han de someterse a investigación, la furgoneta y su dotación pasan la noche, aproximadamente entre las 23,00 horas y la salida del sol, circulando por las rutas convenidas. Se espera que cuando queden completados los análisis, se dispondrá de datos útiles para una planificación más eficaz de las instalaciones de alumbrado de las calles.

J.R. Coaton e I. Conner

La ciencia de la holografía fue desarrollada por el Profesor Gabor, corriendo a cargo de Leith y de Upatneks la investigación ulterior, precediendo a todo elio el invento del laser de gas.

Por medio de una fotografía normal, sólo se logra una imagen plana bimensional; el holograma produce una imagen tridimensional que puede someterse a profunda exploración. Esta segunda imagen se logra en una habitación fotográfica obscura en la que la escena o el objeto que ha de reproducirse se ilumina con un rayo laser expandido, al tiempo que se dirige sobre la placa sensitiva luz procedente de la misma fuente. El resultado es una configuración aparentemente sin significado, formada por la configuración de interferencia de la luz reflejada desde el objeto y del haz de referencia. El holograma se reproduce iluminándolo con el haz de referencia solamente, apreciándose así en tres dimensiones en la forma que existía originalmente; el observador puede incluso inspeccionar las zonas ocultas.

La holografía se utiliza para examinar las corrientes de gas de lámparas de filamento, estudiando las configuraciones de interferencias originadas cuando se realiza una doble exposición. Este método permite el logro de mucha más precisión que la obtenida antiguamente mediante el empleo de envolturas de cristal de fabricación especial.

In questa edizione.

LE APPARECCHIATURE D'ILLUMINAZIONE IN ATMOSFERE ESPLOSIVE O CORROSIVE 2
R. F. Chatt e M. G. Oakley

Le atmosfere esplosive costituiscono l'éterna problema di vari settori industriali tra i quali il settore della petrolchimica; qui le apparecchiature per illuminazione sono esposte al rischio di esplosione oppure funzionano in atmosfere umide o corrosive. Per tal motivo occorre adottare speciali misure protettive.

L'International Protection Code classifica tali apparecchiature in funzione del grado di protezione contro l'umidità e l'ingresso del pulviscolo o altre impurità mentre il British Code of Practice BS 5345 classifica gli ambienti a carattere potenzialmente pericoloso. Vengono descritte tre zone: la zona 0 nella quale sono permanentemente presenti gas o vapori esplosivi, la zona 1 dove tale presenza si avvera soltanto durante il normale ciclo di lavoro e la zono 2 in cui tale presenza risulta improbabile oppure si avvera solo per brevi periodi. Sarà pertanto responsabilità dei tecnici stabilire la giusta classificazione degli ambiente.

Nella zona 0 è vietata l'installazione della apparecchiature elettriche mentre nella zona 1 è consentito l'uso di apparecchiature per illuminazione accertatamente antideflagranti, pressurizzate o construite con speciali criteri di sicurezza. Per tali apparecchiature è prescritta la rispondenza alle rigorose norme BS 229, BS 889 e BS 4533 — in Gran Bretagna queste devono possedere il certificato "Buxton" rilasciato dal British Approvals Service for Electrical Equipment (BASEEFA). Nella zona 2 è permessa l'installazione di apparecchiature per illuminazione a costruzione chiusa per le quali è parimenti prescritto il certificato BASEEFA.

Il nuovo British Code of Practice BS 5345 presenta un elenco completo dei gas e vapori infiammabili e specifica le temperature superficiali massime ammissibili per le apparecchiature in oggetto. Occorre tener presente che certi tipi di polvere sono esposivi.

Sono normalmente reperibili in commercio due tipi di apparecchiature per illuminazione a prova di corrosione; in uno dei due tipi, il convenzionale corpo in acciaio viene trattato con una finitura prottettiva. Nell'altro tipo. viene adottato un metodo più accurato — per la serie di apparecchiature LU della Thorn — ossia l'intera superficie esterna dell'apparecchiatura è ricavata con materiale a prova di corrosione.

Per accertare che vengani impiegati il giusto materiale e l'involucro adatto occurrerà specificare la sostanza corrosiva, la relativa concentrazione, la temperatura e l'umidità.

LA LUCE E GLI ESSERI VIVENTI 6
B. Jewess

La luce non ci permette solo di vedere; le caratteristiche spettrali delle parti dello spettro elettromagnetico che ricadono tra i 380 e 700nm influiscono sulla salute e sullo sviluppo di uomini, animali e piante. Lo spettro di determinati tipi di luce artificiale può differisse notevolmente da quello della luce solare invece la radiazione di quelle specifiche a lunghezza d'onda che influenscono sugli animali e sulle piante rimane invariata ad variore delle sorgente.

Un tipico esempio degli effetti diretti è l'eritema o la scottatura da eccessiva esposizione al sole e la conseguente pigmenazione dell'epidermide. Meno noto è invece l'impiego della raoliazioni luminose che ricadono nell'estremità blu dello spettro per il trattamento dell'itterizia dei neonati o operbilirubinemia; in questo caso sono state usate, con ottimi risultati, lampade a fluorescenza blu, a sostituzione della luce solare.

Per il trattamento della psoriasi, una malattia cutanea assai sgradevole, si ricorre all'irradiazione con raggi ultravioletti ad onde lunghe, dopo la consumazione dello psoralene; questo trattamento conferisce al paziente un'accentuata abbronzatura eliminando in pari tempo le dolorose chiazze create dalla malattia. Tuttavia, occorre ripetere le irradiazioni, successivamente, ad intervalli regolari. Per questo trattamento sono state usate estesamente le lampade a fluorescenza borealizzate quantunque le lampade agli alogenuri metallici Graph-X si siano dimonstrate a loro volta assai efficaci.

Lo sviluppo delle piante è influenzato dalla luce. L'assorbimento della clorofilla avviene nella proporzione più elevata nei settori blu e rosso dello spettro; per tale motivo si possono impiegare lampade che emettono la magioranza dell'energia in dette regioni, per i fini dell'irradiazione. Indubbiamente verranno individuati altri us dell'irradiazione con il progressivo aumentare della conoscenza attinente le reazioni chimiche e fisiche nelli piante e negli animali.

ILLUMINAZIONE DI UN IPPODROMO SVEDESE 9
Bernth Jansson

La nuova pista per le corse al trotto di Malmö a quanto si afferma, è la sola in Europa illuminata da lampade CSI, sistemate su alti piloni. Tre piloni di 39 metri, sulla mezzeria della pista sostengono complessivamente 209 proiettori da 100W del tipo CSI; altre 153 lampade lineari ad alogenuri metallici sono sistemate nei gruppi Thorn, sulle due tribune e su un pilone di 18 metri situato tra le tribune stesse.

Quest'installazione fornisce in media 445 lux sul piano orizzontale e 115 sul verticale nel rettifilo finale, e 220 e 460 lux sulla dirittura opposta con un carico di 540 kW. I piloni vennero eretti in due fasi; il proiettori CSI vennero fissati alle strutture, a terra indi vennero posti in posizione, mediante una gru.

CONSIDERAZIONI SUI SISTEMI DI ILLUMINAZIONE 12
D. C. T. Brooks

In questi ultimi anni la Thorn ha acquisito reputazione internazionale per la specializzazione nell'illuminazione dei campi di calcio e degli stadi sportivi; tali installazioni forniscono preziosa pubblicità quantunque occorra tener presente che gli impianti di illuminazione degli ambienti industriali, commerciali e ricreativi rappresentano un aspetto ancor più importante dell'attività della società oltre a revistire un marcato valore nell'economia nazionale.

Esistono ancora troppe installazioni all'aperto in cui l'uso di apparecchiature per illuminazione di criterio antiquato comporta un considerevole spreco di energia. Gli enti incaricati dell'illuminazione stradale sono consapevoli dei vantaggi ottenibili cambiando le lampade a filamento con lampade al sodio a bassa pressione; tuttavia ancora oggi gli impianti di troppi complessi industriali e commerciali sono del tutto inadeguati.

Le leggi sulla sicurezza sul lavoro sottolineano la necessità di una buona illuminazione in dette situazioni; il nuovo BS 4533 afferma che la apparecchiature per illuminazione recanti il marchio BS Safety Mark sono meccanicamente ed elettricamente sicure. Tutte le apparecchiature Thorn rispondono alle suddette prescrizioni.

Una buona illuminazione all'esterno dei fabbricati contribuisce a ridurre i furti e gli atti vandalici; i nuovi tipi di lampada, tra i quali il tipo SON consentono ragguardevoli economie nel consumo di energia. Quanto detto si nota in modo particolare nelle lampade SOX specificamente consigliate quando la resa cromatica non rivesta particolare importanza.

Le lampade ad alogeni trovano esteso impiego nella portinerie ed in analoghe posizioni in cui occorra un'illuminazione immediata ed intensa, oltre al fatta che diventano crescentemente popolari in varie altre applicazioni, a carattere ricreativo.

LA TECNICA DI COSTRUZIONE DELLE APPARECCHIATURE PER ILLUMINAZIONE 17
L. W. V. Turner

Lo stabilimento Thorn Smart & Brown di Rotherwas, nei pressi di Hereford, ha svolto attività per un gran numero d'anni. Recentemente è stato completamente rimodernato; le opere di rimodernamento sono culminate nella realizzazione di una moderna fonderia per alluminio. Questo fabbricato, snello e ben ventilato è circa due volte più grande di quello precedente ed è dotato di un complesso di unità 'Hi-Pak' con lampade MBIF che emettono un totale di 500 lux. Il machinario per la pressofusione ridurre considerevolmente il consumo di alluminio ha consentito di oltre a sveltire il procedimento di lavorazione. L'installazione di speciali impianti ha permesso di svolgere simultaneamente parecchie operazioni di finitura. In uno speciale reparto viene effettuato lo stampaggio della vetroresina; questo sistema consente una notevole riduzione sui costi di produzione e di ricavare apparecchiature per illuminazione a prova di corrosione, ad un ritmo operativo altamente economico.

Nello stabilimento vengono anche prodotti regolatori diffusori e per cui in plastica tutti componenti fondamentali delle apparecchiature Thorn per l'illuminazione stradale, per l'illuminazione per proiezione e per l'impiego in atmosfere corrosive vengono prodotti in un'unica fabbrica; basterà aggiungere i portalampade e l'apparecchiatura di controllo prodotti in altri stabilimenti della società.

Queste migliorate condizioni di lavoro sono state apprezzate dal personale e servono al miglioramento delle relazioni aziendali.

LA CHIMICA A LEICESTER 21
V. Goddard

Il reparto chimica dei laboratori di ricerca Thorn di Leicester svolge due funzioni basilari: fornisce i servizi analitici ai laboratori ed agli stabilimenti ed esegue la ricerca di base. Altre attività di questo gruppo sono lidentificazione e quantificazione dei gas, la rivelazione della impurità contenute nei gas e in altri componenti delle lampade e l'analisi delle cause della perdite nell'emissione luminosa e dei guasti prematuri

I gas vengono identificati mediante due tecniche: la spettrografia di massa e la cromatografia del gas-liquido. Queste tecniche si integrano reciprocamente poiché la spettrografia di massa permette di rilevare le impurità e la chromatographia del gas-liquido permette di misurare con alta precisione i costituenti più importanti. Per esempio, questa tecnica consente la misurazione delle quantità di acqua ed ossigeno nei composti di alogenuri metallici prima della immissione nelle lampade, riducendo il rischio di erosione degli elettrodi.

Mediante la spettrografia per assorbimento atomico si misura il contenuto in ferro del filamento di tungsteno di una lampada ad alogeni. Un quantitativo eccessivo di ferro causerà la diminuzione dell'alogeno, durante la vita della làmpada. Questa tecnica permette inoltre di verificare i livelli di impurità nella polvere di allumina usata nella produzione del tubo a scarica delle lampade al sodio ad alta pressione endi misurare la trasmissione UV dei tubi in quarzo fuso delle lampade a vapori di mercurio. Uno speciale forno di carburazione consente di rintracciare quantitativi letteralmente microscopici.

Lo studio delle sostanze che contaminano l'atmosfera si svolge usando elettrodi con selettività ionica. Questi vengono usati per l'analisi ambientale dei fumi tossici e per l'analisi del contenuto in idrogeno delle làmpade ad alogeni.

Altri metodi, quali l'analisi termica e la classificazione rilievi degli elementi, mediante raggi X vengono a lora volta usati specialmente allo scopo di identificare gli elementi depositi sulle pareti del bulbo, i depositi cristallini e le inclusioni. Ladozione di tecniche analitiche più avanzate consentirà di risolvere i problemi di lavorazione e di migliorare i prodotti.

UN LABORATORIO SEMOVENTE PER L'ILLUMINAZIONE STRADALE 25
R. Hargroves e J. Green

Idealmente, l'illuminazione stradale dovrebbe produrre un'illuminazione brillante sulla superficie con minimo abbagliamento, senza chiazze scure; tuttavia, l'effetto individuale di tali fattori, sul tasso degli incidenti non è mai stato stabilito con precisione. Per tal motivo, il Department of the Environment, tramite il Transport and Road Research Laboratory ha avviato un programma di ricerche. Il relativo contratto è stato assegnato alla Thorn Lighting nel 1974.

In questa circostanza venne utilizzato un furgoncino, trasformato in laboratorio; le apparecchiature permisero di rilevare migliaia di letture, in una sola notte registrandole su nastri video e su un registratore di dati. L'impiego di un impianto televisivo a circuito chiuso consenti di verificare immediatamente i risultati ripetendo la registrazione, se necessario. L'apparecchiatura autotrasportata e, in particolare, il posizionamento degli strumenti registratori, tra i quali le cellule fotoelettriche, hanno implicato una notevole ingengnosità.

I nastri video vengono analizzati nel laboratorio Thorn di Enfield dove si ricorre ad apparecchiature di speciale progettazione ed al calcolatore da laboratorio.

L'investigazione venne limitata alle strade ad una corsia, con limite di velocità a 30 miglia orarie ad altre strade esenti da limiti di velocità; per ricavare una campionatura statistica attendibile venne stabilita la necessità di effetuare all'incirca 100 verifiche su ciascun tipo di strada, in clima asciutto e piovoso. Vengono compiute regolari visite ad uno specifico numero di piccole città; le strade de controllare vengono percorse di giorno indi, iniziando alle ore 23.00 circa, il furgoncino e l'equipaggio ripetono il percorso, fino all'alba. A quanto previsto, quando l'analisi sarà completa, sarà in grado di fornire dati preziosi per una pianificazione più razionale degli impianti d'illuminazione stradale.

L'HOLOGRAFIA LA RELATIVE APPLICAZIONI 28
J. R. Coaton e I. Conner

L'olografia è una scienza elaborata dal Professor Gabor; successivamente vennero effettuate ricerche da Leith e Upatneks, guinge per ultima l'invenzione dei laser a gas.

In una normale fotografia viene riprodotta un'immagine piatta bidimensionale; l'ologramma produce invece un'immagine tridimensionale che può venire esplorata in profondità. In questo caso si ricorre alla convenzionale camera oscura dove la scena o l'oggetto da riprodurre viene illuminato mediante un raggio laser mentre la luce proveniente dalla stessa sorgente viene diretta sulla lastra sensibile. Il risultato presenta una configurazione praticamente indecifrabile costituita dai motivi di interferenza della luce riflessa dal dall'iggetto e dal raggio di riferimento. L'ologramma viene 'riprodotto' illuminandolo con il solo raggio di riferimento e, a questo punto esso apparirà in tre dimensioni, esattamente come l'originale. Sarà possibile persino osservare attorno agli angoli.

L'olografia viene utilizzata per esaminare le correnti di gas nelle lampade a filamento osservando i motivi di interferenza creati quando si esegue una doppia esposizione. Questo metodo consente livelli di precisione di gran lunga superiori a quelli realizzati precedentemente, quando venivano usati involucri di vetro di speciale esecuzione.

Thorn Lighting Limited
UK Branches

Belfast
Prince Regent Road, Castlereagh
Belfast BT5 6QR
Telephone 0232-54122
Telex Thornlite Belfast 74695

Birmingham
Thorn House, Aston Church Road
Saltley Trading Estate, Birmingham B81 BE
Telephone 021-327 1535
Telex Thornlite Birmingham 33235

Cardiff
Thorn House, Penarth Road
Cardiff, Wales CF1 7YP
Telephone 0222-44200
Telex Thornlite Cardiff 49334

Glasgow
Thorn House, Lawmoor Street
Glasgow G5 0TT
Telephone 041-429 6222
Telex Thornlite Glasgow 77630

Leeds
Thorn House, 3 Ring Road
Lower Wortley, Leeds LS12 6EJ
Telephone 0532-636321
Telex Thornlite Leeds 55110

London
Victoria Trading Estate, Victoria Way
Charlton, London SE7 7PA
Telephone 01-858 3201 (order office) or
01-858 3281 (all other enquiries)
Telex Thornlite Charlton 896171

Manchester
Thorn House, 2 Claytonbrook Road
Clayton, Manchester M11 1BP
Telephone 061-223 1322
Telex Thornlite Manchester 668642

Reading
10 Richfield Avenue, Reading RG1 8PA
Telephone 0734-53257

Southampton
West Quay Trading Estate, West Quay Road
Southampton SO9 1FF
Telephone 0703-27401

Government Contracts &
Order Office
Atlas House, Great Cambridge Road
Enfield EN1 1UL
Telephone 01-363 5353

Theatre Lighting Division
Angel Road Works, 402 Angel Road
Edmonton, London N18 3AJ
Telephone 01-807 9011
Telex Thornlite Edmonton 23157

Airfield Lighting Division
Regency House, 154 Caledonian Road
London N1 9RD
Telephone 01-837 4391/3

Head Office and Showroom
Thorn House, Upper Saint Martin's Lane
London WC2H 9ED
Telephone 01-836 2444
Telex Thorn London 24184/5

Thorn Lighting Limited
Overseas Companies

Australia
Thorn Lighting Industries Pty Limited
210 Silverwater Road, Lidcombe, NSW 2141

Austria
Thorn Electrical Industries GmbH
Erzherzog-Karl-Strasse 57, A-1220 Vienna

Belgium
SA Thorn Benelux NV
14 Rue General Tombeur
1040 Brussels

Canada
Thorn Lighting Canada Limited
7621 Bath Road, Mississauga
Ontario L4T 3T1

Denmark
Thorn Lampe A/S
Fabriksparken 4, 2600 Glostrup, Copenhagen

France
Thorn Electrique SA
26 Rue de la Baisse, F-69625 Villeurbanne

Germany
Thorn Licht Beleuchtungsges mbH
D-2000 Hamburg 61, Borsteler Chaussee 287

Italy
Società Industriale Vicentina Illuminazione SpA
Casella Postale 604, 1-36100 Vicenza

Società Italiana Distribuzione Articoli
Illuminazione SpA, Via Venezia, 55, Padua,
1-35100

New Zealand
Thorn Electrical Industries (NZ) Limited
PO Box 15150, New Lynn, 13a Veronica Street
Auckland 7

Norway
Norske Thorn A/S
Pilestredet 75c, Postboks 7065, Oslo 3

Republic of Ireland
Thorn Lighting Limited
320 Harolds Cross Road, Dublin 8

South Africa
Thorn Lighting (SA) (Pty) Limited
PO Box 43075,
corner Watt and Edison Streets
Industria, Transvaal

Sweden
Thorn Belysning AB
Anderstorpsvägen 2-6, Fack
S-17104 Solna

USA
Thorn Lighting (US) Inc
23 Leslie Court, Whippany
New Jersey 07981

Thorn Lighting Limited
International Division
Head Office & Showroom
Thorn House, Upper Saint Martin's Lane
London WC2H 9ED
Telephone 01-836 2444
Telex Thorn London 24184/5
Cables Eleclampo WC2

1972
THE QUEEN'S AWARD FOR TECHNOLOGICAL ACHIEVEMENT

1976
THE QUEEN'S AWARD FOR EXPORT ACHIEVEMENT

THORN LIGHTING
A member of the Thorn Group